CHAPTER IV
ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter contains the scientific and analytical foundation for comparisons between the alternatives. The alternatives are intended to define the issues sharply and provide a clear basis of choice. Because this is a supplemental EIS the alternatives in this document focus the issues sharply on whether or not there should be snowmobiles allowed in the three park units, and if they are allowed, under what circumstances. Chapter III presents the affected environment, focused on impact areas that may be affected by differences in the SEIS alternatives. Some impact topics addressed in the FEIS require no additional analysis, and these were dismissed near the beginning of Chapter III. Much of the material presented in the FEIS environmental consequences section remains valid – in regard to methods and assumptions as well as for similar alternative features in the FEIS – and are be incorporated by reference as necessary.

IMPACT TOPICS ADDRESSED IN THE SEIS

A number of impact topics remain to be discussed because new information and analyses may have altered the assessment of effects from that presented in the FEIS. *See Impact Topics Addressed* near the beginning of Chapter III. The direct, indirect and cumulative effects in regard to these topics are disclosed.

For each impact topic the methods and assumptions used in its analyses are presented, followed by the direct and indirect effects for each alternative. At the end of the chapter, cumulative effects are addressed for each alternative, as are impacts on adjacent lands. A series of closing topics discuss the following:

- Impairment of Park Resources and Values
- Adverse Effects that Cannot be Avoided
- Irreversible or Irretrievable Commitments of Resources
- The Relationship Between Short Term Uses of the Environment and Maintenance and Enhancement of Long Term Productivity.

DIRECT AND INDIRECT EFFECTS, BY IMPACT TOPIC

THE EFFECTS OF IMPLEMENTING THE ALTERNATIVES ON SOCIOECONOMICS

Summary of Changes in Impacts Between FEIS and SEIS

Nine specific impact estimates were calculated for the SEIS corresponding to estimates for three analysis areas for each of the four alternatives. Table 35 details the changes in total economic output and employment associated with each of the estimates. In all four SEIS alternatives the estimated output and employment impact for the 5-county and 3-state analysis areas are less than one-half of one percent of baseline levels. This is consistent with results found for FEIS alternatives.

Table 35. Estimated economic output and employment impacts for SEIS alternatives compared to selected FEIS alternatives.

SEIS and FEIS alternatives	Analysis area	Change in output (million 1997 dollars)	% Change in output	Change in employment No. of jobs	% Change in employment from existing
SEIS Alternatives 1a[1] and 1b Snowcoach and ski or snowshoe travel only	5-county 3-state W. Yell.	-15.9 to –21.1 -18.4 to +7.0 ~ 45% of 5-county loss	< 1% < 1%	-378 to -499 -471 to +170	< 1% < 1%
SEIS Alternative 2 Clean/quiet machines – limit 500 per day at West Entrance	5-county 3-state W. Yell.	-2.9 to 15.8 -3.3 to -6.5 ~ 45% of 5-county loss	< 1% < 1%	-68 to -136 -79 to -159	< 1% < 1%
SEIS Alternative 3 Clean/quiet machines – 330 per day at West Entrance – all trips guided	5-county 3-state W. Yell	-8.6 to -11.1 -9.5 to -12.3 ~ 45% of 5-county loss	< 1% < 1%	-203 to –262 -230 to -299	< 1% < 1%
FEIS Alternative A (Existing Condition)	5-county 3-state W. Yell	No loss No loss No Change	0% 0%	No loss No loss	0% 0%

[1] Increased winter visitation from current summer visitors to the park under this management option could substantially offset the estimated output and employment reductions from current winter visitors. Impacts of alternative 1b are the same as in alternative 1a, except that they would be offset by a year.

SEIS and FEIS alternatives	Analysis area	Change in output (million 1997 dollars)	% Change in output	Change in employment No. of jobs	% Change in employment from existing
No change in Management					
FEIS Alternative B Clean/quiet machines, no limits– Wheeled mass transit from West Entrance to O.F.	5-county 3-state W. Yell	-13.2 -14.4 winter economy-18.4%	< 1% < 1%	–312 -351	< 1% < 1%
FEIS Alternative D Clean/quiet machines. No limits. No access from YNP East Entrance	5-county 3-state W. Yell	-1.3 No loss No loss	< 1% 0%	-32 No loss	< 1% 0%

Methods for Analyzing Impacts

The general methodologies for analyzing impacts associated with alternative winter management plans within the GYA parks is described in detail in the FEIS (Chapter 4). These previously described methodologies are also employed in the following SEIS analysis. Where appropriate, data and assumptions used in the FEIS analysis are modified based on new information and data that have become available since the publication of the FEIS.

Summary of Regulations and Policies

The National Environmental Policy Act's guiding regulations require analysis of social and economic impacts resulting from proposed major federal actions when an environmental impact statement is prepared. In addition, Executive Order 12898, dated February 11, 1994, on "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" requires federal agencies to assess the impact of actions on minority and low-income communities. The issue of impacts on minority and low-income populations was examined in depth in the FEIS. This analysis showed no substantial variation in low-income or minority impacts across the broad range of alternatives. The minority and low-income topic was therefore dismissed from further consideration in the SEIS. Although

there are no specific regulations requiring protection of social values, impacts on them are considered an important piece of the federal planning processes. The assessment of the economic effects of the proposed action follow the general principles outlined in the U.S. Water Resources Council's *Principles and Standards for Planning Water and Related Land Resources* (U.S. Department of Interior, Water Resources Council 1984).

Assumptions and Methods

Much of the analysis contained in the FEIS was supported by data collected between the last week of January and the first week of March 1999 from winter visitors YNP and GTNP who were surveyed regarding their winter trips to the GYA and their opinions about winter management of the national parks in the GYA. The FEIS (pages 199-202) describes the assumptions and data sources used in estimating the impacts of the FEIS alternatives on the regional economy, income and employment, winter recreation, park visitors, and social values. The questions contained in the 1999 Winter Visitor Survey were designed to gather information and opinions specific to the alternatives examined in the FEIS. This SEIS analysis examines four alternatives, three of them varying in some fashion from the existing decision (FEIS alternative G). Analysis of these new alternatives (alternatives 1b, 2, and 3) is complicated. Alternatives 2 and 3 are particularly complicated by not having survey data on winter visitor opinions and reactions specific to them. The following section details the new assumptions and data sources used in analysis of the socioeconomic impacts associated with the SEIS alternatives. Assumptions and data sources are discussed below only in cases where they differ or augment those used in the FEIS analysis (FEIS 119-202).

New Assumptions Common to All Alternatives

The estimated baseline level of visitors to YNP and GTNP (including the Parkway) presented in the FEIS was 88,250. One assumption used in deriving this estimate has been modified in the SEIS analysis. Rather than applying an equal estimate of the number of entrances into the parks that are actually re-entries by the same person on the same trip to the region, differences are allowed for varying re-entrance rates at different park entrances. For the SEIS analysis it is assumed that the YNP North and West Entrances have a 25% re-entry rate, as used in the FEIS analysis. The East and South Entrances, however, are assumed to have a re-entry rate of 0%.

The impact of these new re-entry assumptions is to change the estimated baseline number of visitors to the parks from 88,250 (used in the FEIS) to 96,842 (used in the following SEIS analysis).

Many of the alternatives provide for a gradual change in the number of permitted snowmobiles to some final level. For purposes of brevity, qualitative and quantitative impacts are presented here only for the final long-run level of use. In that context, alternatives 1a and 1b are the same.

New Assumptions and Data, by Alternative

Alternative 1a, No-Action, and Alternative 1b. No new assumptions were used in this analysis other than the assumption common to all three alternatives of unequal re-entry rates across park entrances.

Alternative 2. From a socioeconomic standpoint, this alternative presents two significant changes or constraints for park visitors: 1) snowmobile entrances per day at the West Entrance (after three years) would be limited to 500 machines (in this alternative, daily snowmobile limitations at the other YNP entrances are above recent historical maximums, and are therefore not constraining), and 2) snowmobiles within the park (again, after three years) must conform to clean/quiet restrictions. The assumptions employed in the SEIS analysis as to how GYA visitors would respond to these restrictions are derived as follows:

As a baseline for snowmobile entrances through the West (and other) park gates, data from the winter of 1997-1998 is used. This data is consistent with that used in the FEIS analysis, and represents a fairly average year for park visitation.

Scenario 1: Analysis of the responses to the 1999 Winter Visitor Survey found that of the survey respondents who were primarily snowmobiling on their trip to the GYA, 59.6% said they would visit the area less frequently if no snowmobile access were allowed to the park. For days when the historical (1997-1998) level of snowmobiles through the West Entrance exceeds 500 machines, it is assumed that 59.6% of the excess over 500 machines would not come to the park due to the restrictions. The remaining 40.4% would choose to still make their trip, but use snowcoaches to access the park, or only recreate on national forest lands outside park boundaries.

Scenario 2: An alternative assumption to that above is that of those snowmobile visitors to the park assumed to be lost in Scenario 1, 50% would schedule their YNP trips for non-peak use periods (when historical entrances at the West Entrance are below 500 machines). Given

the actual historical pattern of use for 1997-1998, this would result in a loss of 29.8% of the excess demand for snowmobile entrances through the West Entrance to YNP.

While cleaner and quieter 4-stroke snowmachines are more expensive than comparable 2-stroke machines, information on 2001-2002 rental rates for these machines in West Yellowstone show their daily cost being in the low to mid-range of all types of machines rented. However, Amfac Parks and Resorts is exclusively renting Arctic Cat 4-stroke snowmobiles this winter and is charging $182 per day for a two-rider machine (includes tax, damage waiver up to $500 and helmet). These rates are negotiated with NPS and are based on cost recovery and reasonable profit. Information from YNP (pers. com. John Sacklin, YNP Planning Office) indicates that 4-stroke machines are approximately 30 to 35% more expensive to purchase than comparable 2-stroke machines. This increased cost should (in the long run) lead to marginally lower demand for rental and purchased, 4-stroke machines. Combined with the alternative 2 supply constraints for snowmobile access to the park, however, the impact of the price increases is unknown. What is known is that 88.1% of non-resident respondents to the 1999 winter survey said they would still have made their trip if their total costs had increased by $100 (Duffield and Neher 2000a). Also, results from the 2000-2001 Wyoming Snowmobile Survey (McManus et al. 2001) indicate 50.2% of Wyoming resident snowmobilers, 50.5% of nonresidents, and 64.4% of snowmobile outfitter clients would be willing to pay a higher price to use cleaner, quieter snowmobiles. Additionally, the 1999 survey asked about willingness to pay for a cleaner and quieter snowmobile. Visitors that rent snowmobiles (42% in the survey) indicated that they would pay $46.09 per day to rent a "clean and quiet" sled. For the analysis of alternatives 2 and 3, it is assumed that the range of impacts from the Scenario 1 and 2 visitation assumptions, above, includes any marginal impacts on demand of increased machine rental and purchase prices.

Alternative 3. This alternative presents four significant changes or constraints for park visitors: 1) snowmobile entrances per day at the West Entrance (after 2 years) would be limited to 330 machines (daily snowmobile limitations, in this alternative, at the other YNP entrances are above recent historical maximums, and are therefore not constraining); 2) snowmobiles within the park (after 2 years) must conform to clean/quiet restrictions; 3) all snowmobile visitors to YNP must be accompanied by an NPS permitted guide; and 4) no snowmobile access would be allowed to the park after the Presidents' Day weekend: only snowcoach, snowshoe, or ski travel would be allowed after this time. The assumptions

employed in the SEIS analysis as to how GYA visitors would respond to these restrictions are as follows:

As a baseline for snowmobile entrances through the West (and other) park gates, data from the winter of 1997-1998 is used. This data is consistent with that used in the FEIS analysis, and represents a fairly average year for park visitation.

Scenario 1: Analysis of the responses to the 1999 Winter Visitor Survey found that of the survey respondents who were primarily snowmobiling on their trip to the GYA, 59.6% said they would visit the area less frequently if no snowmobile access were allowed to the park. For days when the historical (1997-1998) level of snowmobiles through the West Entrance exceeds 330 machines, it is assumed that 59.6% of the excess over 330 machines would not come to the park due to the restrictions. It is also assumed that 59.6% of the historical snowmobile use in the period after the Presidents' Day weekend will be lost.

Based on responses to the 1999 Winter Visitor Survey, alternative 3 also has the potential to increase use from certain current winter users. The FEIS analysis estimated that the total ban of snowmobiles from YNP would cause those individuals who favor the ban to increase total winter use by approximately 4.5% over the baseline. Alternative 3 combines significant constraints on snowmobile numbers in December through Presidents' Day with a total ban on the machines after Presidents' Day. For the alternative 3 analysis it was assumed that the increased use attributable to the group who favors restrictions on snowmobiles would be one-half of that estimated in the FEIS, or a 2.25% increase to baseline.

Scenario 2: An alternative assumption to that above is that due to significant constraints on the supply of permits for snowmobile use in YNP, historical use over the alternative 3 limits will fill all available capacity in off-peak days. In this scenario during the mid-December through Presidents' Day weekend period, all days would have 330 snowmobiles using the West Entrance.

As in Scenario 1, it is estimated that the snowmobile restrictions will lead to a 2.25% increase in baseline use attributable to those who favor restrictions on snowmobiles within the park.

In addition to the added cost of renting or buying a clean/quiet snowmobile, alternative 3 would also require the use of a guide for trips into YNP. For 2001-2002, the average NPS-approved guide fee was between $20 and $25 per person per day. As was discussed for

alternative 3, this increased cost would lead to decreased demand for trips to the park, all other things being equal. Additionally, many current visitors (perhaps particularly resident visitors) may not want to take a guided trip. Data from the 1999 winter survey indicates that approximately 12% of nonresidents and 6% of residents (of ID, MT, and WY) utilized guides. At the West Entrance, this would imply that only about 10% or 50 of the average daily 550 snowmobiles entering the park were guided. It is unknown whether these considerations would lead to actual use even lower than that of Scenario 1. Combined with significant supply constraints for snowmobile access to the park, however, the impact of the price increases is unknown.

Impacts Common to All Alternatives

Actions that affect park visitation levels can impact socioeconomics. If visitor use capacities different than current levels are enforced by reservations, permits, or differential fees, there may be significant impacts on socioeconomics. At this time, future visitor use capacity changes, if any, (other than those implied by the current alternatives) are subject to adaptive management adjustments.

Unless otherwise noted, the duration of all impacts described below is long term.

The Effects of Implementing Alternatives 1a and 1b on Socioeconomics

Alternative 1a represents the current decision. Alternative 1b represents the current decision implemented one year later. For purposes of analysis and discussion, these alternatives are the same and will be referred to as a single course of action below. These alternatives would allow only oversnow mass transit vehicles (snowcoaches) that can meet strict emissions and sound requirements, and ski and snowshoe access to YNP during the winter season. The following analysis of the socioeconomic impacts associated with this winter use management alternative differs slightly from that presented for alternative G in the FEIS. The primary source of this difference is the use of a slightly higher estimated baseline visitation to the parks (as described in Chapter III, *Methods and Assumptions for SEIS Impact Topics*). The modified analysis results for this alternative is presented below.

GYA Regional Economy. The 1999 GYA winter visitor survey asked respondents how their visitation would be affected if both YNP and GTNP were open only to snowcoach, skiing, and snowshoeing. Based on the responses to this survey question, visitation to the GYA by winter visitors who live outside of the 5-county area would be reduced by 33.4% if winter travel were restricted to either snowcoach or nonmotorized travel. This estimated

reduction in visitation is a net change that takes into consideration the responses of those current winter visitors who said they would visit more often if the change occurred. Also considered in the calculation were those respondents who said they would visit the same, but would shift their use to other areas of the GYA (for example from park lands to national forest lands). Table 35 shows that for the largest classes of winter user groups (snowmobilers, skiers, and snowcoach riders) anticipated changes in visitation under alternative 1a changes vary dramatically. While 59.6% of those who snowmobiled on their trip said that they would visit less frequently under this management plan, only 12% of skiers and 14.1% of snowcoach riders said they would visit less frequently. Conversely, while only 5.6% of snowmobilers said they would visit more frequently, 33.7% of skiers and 22.8% of snowcoach riders said they would increase their visitation. The estimate of a 33.4% decrease in visitation to the five county area takes into consideration the anticipated changes in visitation by these diverse groups of winter park users.

Table 35. Visitation response to alternatives 1a and 1b, by visitor type.

If YNP were open only to snowcoach, skiing, and snowshoeing, the visitor would:			
Response	Snowmobile User	Cross-country Skier	Snowcoach Rider
Not change visitation	17.8%	37.2%	42.5%
Visit less frequently	59.6%	12.0%	14.1%
Visit more frequently	5.6%	33.7%	22.8%
Visit the same amount	4.2%	6.5%	7.8%
Not Sure	12.8%	10.7%	12.8%
Sample Size	792	247	106

In the winter visitor survey, park visitors who reside outside of the 5-county area made up 85.9% of total sampled visitors. If 33.4% of these non-five county resident visitors decided not to recreate within the GYA because of the motorized travel restrictions, the local economy would lose these potential visitors' local area expenditures.

Based on the winter survey responses and the IMPLAN input/output model, it is estimated these travel restrictions would reduce the total economic output in the 5-county GYA area by an estimated $21,100,000. Additionally, it is estimated that 499 jobs within the GYA would be lost due to reduced nonresident expenditures in the area.

While a $21,100,000 loss in output is a minor impact on the overall 5.7 billion economic output of the five counties, this impact will likely be concentrated in small communities near

the parks. The impacts of alternative 1a travel restrictions on small local economies such as West Yellowstone could be more significant. However, the correlation between West Entrance visits and the West Yellowstone economy is not as close as one might expect (Chapter III *Socioeconomics, FEIS*). Accordingly, it is difficult to predict the actual effect of a change in park visitation on the local West Yellowstone economy.

The town of West Yellowstone levies a local option tax targeted at tourist spending. As noted in Chapter III of the FEIS, tax records show that for the period 1989-1999 tourist expenditures have been growing at a 10% annual rate. Additionally, tourist spending in the winter months accounts for approximately 25% of year-round tourist spending in the town. Given the relative size of the West Yellowstone winter economy (relative to year-round totals) and the recent growth trends for tourist spending, the estimated visitation reductions associated with alternative 1a would likely have a moderate to major short-term negative impact on the town's winter economy, but a minor impact on the year-round economy of the town.

Under the assumption that the economy is closely related to winter park visitation, the impact on the West Yellowstone winter economy would be about a 33% decline, but only an 8% decline in the year-round economy. For perspective, this decline is less than the average one year growth rate, so even under this assumption, the impact is likely to be short term. However, these estimates likely overstate the impacts on West Yellowstone and could be viewed as an upper bound. The impact projections assume that the change in the West Yellowstone winter economy is proportional to change in park visitation. In fact, there is considerable evidence that historical declines in park winter visitation through the West Entrance to YNP have not resulted in proportional declines in the local economy.

For example, in the winter of 1995-1996 West Entrance visitation decreased by 13.4% over the previous year, but resort tax collection increased by 9.6%. The lack of a proportional relationship between park visitation and the local economy is probably due to the extensive winter recreational opportunities proximate to West Yellowstone, but outside of the park—including 400 miles of snowmobile trails. In other words, even without winter access to YNP from the West Entrance, some snowmobilers would continue to visit West Yellowstone to snowmobile on the national forest lands. Also, results from the 2000-2001 Wyoming Snowmobile Survey (McManus et al. 2001) indicate that if YNP and GTNP were closed to snowmobile access, Wyoming resident snowmobilers, and Wyoming snowmobile outfitter clients would increase their annual number of trips to other trails within the region (MT, ID,

CO, SD, and UT) by 52.1% and 20.6%, respectively. The average visitor to West Yellowstone spends only one day of a multi-day trip snowmobiling in the park. Other factors which might impact visitation levels include snow depth, pricing policies, and advertising efforts.

The estimates of reductions in GYA visitation and nonresident expenditures are based on responses to a survey of current winter visitors. The 1999 YNP summer visitor survey asked respondents who had not previously visited the park in the winter whether they would visit the park next winter if a snowcoach, ski and snowshoe only policy were adopted. Responses from this group indicate that new winter users would be attracted to YNP under the policy change and their increased visitation would serve to offset a portion of the estimated visitation losses detailed above. Rather than a 33% reduction in visitation, the reduction could be on the order of 25%. As noted by some local businesses in comments in the DEIS, a change in policy may lead to economic diversification and help some firms that lost business from a variety of users as snowmobiles became the dominant use.

3-State Regional Economy. Overall, 65.5% of winter visitors in the GYA winter visitor survey came from outside the 3-state area of Montana, Idaho, and Wyoming. Responses from these visitors indicate that nonresident winter trips to the GYA would drop by 27.8% under alternatives 1a and 1b.

A loss of the regional expenditures by these nonresidents would lead to an overall reduction of $18,400,000 in total economic output and 471 jobs in the 3-state area. This is a negligible negative impact in the context of the regional 3-state economy. This estimated reduction would be lessened to the extent that nonresidents would choose to recreate at other locations within the 3-state region instead of in the GYA. The extent of any such substitution behavior is unknown.

Responses from the summer YNP visitor population indicate that increased interest in visiting the park in the winter months under the new management plan could generally offset the expected losses in visitation from the current nonresident winter users, and may in fact lead to a approximate 11% increase in winter visitation.

Town of West Yellowstone. The FEIS provided estimates of output and employment impacts on both the 5-county GYA area and the 3-state region. The SEIS presents impacts on the gateway community of West Yellowstone, MT in addition to the 5-county and 3-state estimates. Overall, the direct spending impacts associated with alternatives 1a and 1b are

estimated to be approximately 45% of the impacts associated with the 5-county area. The total expenditure impacts for West Yellowstone will be a smaller percentage of the 5-county total impacts (that is, smaller than 45%) because West Yellowstone likely has a significantly smaller expenditure multiplier than the 1.60 multiplier derived for the 5-county area.

Based on available information and survey data it appears that, consistent with the conclusions in the FEIS, a majority of the 5-county impacts would be felt by the local West Yellowstone economy. Further, the output and employment impacts on West Yellowstone would represent a much larger percentage of total annual economic activity than did the estimated impacts for the larger, more economically diverse 5-county area.

Social Values. Most winter visitors surveyed support mechanized access to the parks. In the context of overall access to the park, the changes under alternatives 1a and 1b are likely to result in moderate adverse impacts by restricting the most heavily used snowmobiling entrance to the parks.

The current winter visitors to YNP are those who are attracted by the current set of opportunities, which include snowmobiling. These visitors support the past management policy. Among summer visitors (as detailed in Chapter 3, FEIS), there is less support for past management allowing snowmobile use. Among the general public, local residents are evenly divided between past management and the current management plan reflected in these alternatives to allow only snowcoach, ski and snowshoe travel.

Nonmarket Values. These alternatives potentially would impact nonmarket values of winter visitors through a reduction in current winter user visitation resulting from the restriction of mechanized travel to cleaner, quieter snowcoaches.

Based on the winter visitor survey, the nonmarket value of a trip to GYA parks is $91. It is estimated that park visitation would be reduced by 33.4% resulting from the management change. Based on current winter visitation levels, these estimated reductions in visitation would translate into a $2,950,000 reduction in the aggregate nonmarket value of winter trips to the parks. This is a minor negative impact. These estimates are based on reduced use by current visitors. It is possible that the loss in total value of visits would be offset in part by a higher quality recreation experience for remaining visitors. This net impact has not been quantified.

Conclusion

In these alternatives, management actions would have a minor to negligible negative impact on the 5-county economy and a negligible negative effect on the 3-state economy through changes in visitation and nonresident visitor expenditures. They also would have a minor negative impact on total current trip nonmarket visitor benefits (through reduced visitation). These alternatives would have a substantially greater negative impact on the economy of West Yellowstone, MT, since an estimated 45% of the total estimated 5-county impacts would be experienced in the town's local winter economy. The changes in these alternatives are likely to result in moderate adverse impacts to some visitors' social values and moderate positive impacts to other visitors.

The Effects of Implementing Alternative 2 on Socioeconomics

Alternative 2 contains a proposal to combine (as primary policy changes) restrictions in snowmobile access through the West Entrance with a requirement for eventual use of clean/quiet snowmobiles within the park. For the analysis of the socioeconomic impacts associated with this alternative, two scenarios are presented. One scenario assumes that, when fully implemented, 59.6% of the excess snowmobile demand (above the 500 snowmobile daily limit) at the West Entrance will be lost. These visitors will choose not to make a snowmobile trip to the park on another day, although about one-third of them will choose to utilize snowcoaches, or other access methods. A second scenario assumes that 50% of the lost excess snowmobile demand from scenario 1 will reschedule trips to utilize days with use levels below the 500 machine maximum. The results of these two scenarios are presented as impact ranges in the analysis below.

GYA Regional Economy. Based on the detailed winter use data for YNP collected during the 1997-1998 winter season, placing a cap of 500 snowmachines allowed per day through the West Entrance to the park would lead to 9.1% decrease in park visitation under the assumption that no use is shifted to off-peak days, and a decrease of 4.6% in visitation assuming that one-half of the excess demand shifts to non-peak use days. In the winter visitor survey, park visitors who reside outside of the 5-county area made up 85.9% of total sampled visitors. If between 4.6% and 9.1% of these non-five county resident visitors decide not to recreate within the GYA because of the West Entrance restrictions, the local economy would lose these potential visitors' local-area expenditures.

Based on this estimated visitation loss and the IMPLAN input/output model, it is estimated these snowmobile entry restrictions would reduce the total economic output in the 5-county

GYA area by between $2,900,000 and $5,800,000. Additionally, it is estimated that between 68 and 136 jobs within the five counties would be lost due to reduced nonresident expenditures in the area. While the high estimated loss of $5,800,000 in output is a minor impact on the overall 5.7 billion economic output of the five counties, this impact will likely be concentrated in small communities near the parks.

3-State Regional Economy. As noted above, it is estimated that placing a cap of 500 snowmachines allowed per day through the West Entrance to the park (among other restrictions) would lead to 9.1% decrease in park visitation under the assumption that no use is shifted to off-peak days, and a decrease of 4.6% in visitation assuming that one-half of the excess demand is shifted to off-peak days.

In the winter visitor survey, park visitors who reside outside of the three-state region made up 65.5% of total sampled visitors. If between 4.6% and 9.1% of these non-three state resident visitors decided not to recreate within the GYA because of the West Entrance restrictions, the local economy would lose these potential visitors' local-area expenditures.

It is estimated that a loss of the regional expenditures by these nonresidents would lead to an overall reduction of between $3,300,000 and $6,500,000 in total economic output and between 79 and 159 jobs in the 3-state area. This is a negligible negative impact in the context of the regional 3-state economy. This estimated reduction would be lessened to the extent that nonresidents would choose to recreate at other locations within the 3-state region instead of in the GYA. The extent of any such substitution behavior is unknown.

Town of West Yellowstone. The FEIS provided estimates of output and employment impacts on both the 5-county GYA area and the 3-state region. The SEIS presents impacts on the gateway community of West Yellowstone, MT in addition to the 5-county and 3-state estimates. Overall, the direct spending impacts associated with alternative 2 are estimated to be approximately 45% of the impacts associated with the 5-county area. The total expenditure impacts for West Yellowstone will be a smaller percentage of the 5-county total impacts (that is, smaller than 45%) because West Yellowstone likely has a significantly smaller expenditure multiplier than the 1.60 multiplier derived for the 5-county area.

Based on available information and survey data it appears that, consistent with the conclusions in the FEIS, a majority of the 5-county impacts would be felt by the local West Yellowstone economy. Further, the output and employment impacts on West Yellowstone

would represent a much larger percentage of total annual economic activity than did the estimated impacts for the larger, more economically diverse 5-county area.

Social Values. Most winter visitors surveyed support mechanized access to the parks. In the context of overall access to the park, the changes proposed in alternative 2 are likely to result in minor to moderate local adverse impacts by restricting access to the 500 users per day at the West Entrance.

Nonmarket Values. Alternative 2 potentially would impact nonmarket values of winter visitors through a reduction in current winter user visitation resulting from the restriction of mechanized travel to cleaner, quieter snowcoaches and 500 snowmobiles per day at the West Entrance.

Based on the winter visitor survey, the nonmarket value of a trip to GYA parks is $91. It is estimated that park visitation would be reduced by between 4.6% and 9.1% resulting from the management change. Based on current winter visitation levels, these estimated reductions in visitation would translate into a $400,000 to $800,000 reduction in the aggregate nonmarket value of winter trips to the parks. This is a minor negative impact. These estimates are based on reduced use by current visitors.

Conclusion

Alternative 2 management actions would have a negligible negative impact on the 5-county economy and a negligible negative effect on the 3-state economy through changes in visitation and nonresident visitor expenditures. Given the historical lack of correlation between year-to-year changes in winter visitation to YNP and the West Yellowstone economy, the reduced visitor expenditures under this alternative could have a minor to negligible short term adverse impact on the winter economy of West Yellowstone, Montana. The impact on the year-round West Yellowstone economy is a negligible short term negative impact. Alternative 2 also would have a minor negative impact on total current trip nonmarket visitor benefits (through reduced visitation). The changes proposed in alternative 2 would be likely to result in minor adverse impacts to some visitors' social values.

The Effects of Implementing Alternative 3 on Socioeconomics

Alternative 3 contains a proposal to combine (as primary policy changes) restrictions in snowmobile access through the West Entrance with a requirement for eventual use of clean/quiet snowmobiles within the park and a requirement that all snowmobile visitors to the park must travel with an NPS approved guide. In addition to these restrictions,

alternative 3 calls for the elimination of snowmobile use in the park after the Presidents' Day weekend. As in the alternative 2 analysis of the socioeconomic impacts, two scenarios are presented: 1) one scenario assumes that 59.6% of the excess snowmobile demand at the West Entrance will be lost (these visitors will choose not to make a trip to the park), and 2) a second scenario assumes that excess snowmobile demand will be shifted so that all winter season days will have a maximum of 330 snowmobiles using the West Entrance and 59.6% of the aggregate excess snowmobile demand above that level will be lost. The results of these two scenarios are presented as impact ranges in the analysis below.

GYA Regional Economy. Based on the detailed winter use data for YNP collected during the 1997-98 winter season, placing a cap of 330 snowmachines allowed per day through the West Entrance to the park would lead to 17.6% decrease in park visitation under the assumption that no use is shifted to off-peak days, and a decrease of 13.6% in visitation assuming that all days have 330 snowmobiles using the West Entrance.

In the winter visitor survey, park visitors who reside outside of the 5-county area made up 85.9% of total sampled visitors. If between 13.6% and 17.6% of these non-five county resident visitors decided not to recreate within the GYA because of the West Entrance restrictions, the local economy would lose these potential visitors' local-area expenditures.

Based on this estimated visitation loss and the IMPLAN input/output model, it is estimated these snowmobile entry restrictions would reduce the total economic output in the 5-county GYA area by between $8,600,000 and $11,100,000. Additionally, it is estimated that between 203 and 262 jobs within the five counties would be lost due to reduced nonresident expenditures in the area.

While the high estimate loss of $11,100,000 in output is a minor impact on the overall 5.7 billion economic output of the five counties, this impact will likely be concentrated in small communities near the parks.

3-State Regional Economy. As noted above, it is estimated that placing a cap of 330 snowmachines allowed per day through the West Entrance to the park (among other restrictions) would lead to 17.6% decrease in park visitation under the assumption that no use is shifted to off-peak days, and a decrease of 13.6% in visitation assuming that one-half of the excess demand is shifted to off-peak days.

In the winter visitor survey, park visitors who reside outside of the 3-state region made up 65.5% of total sampled visitors. If between 13.6% and 17.6% of these non-three state

resident visitors decide not to recreate within the GYA because of the West Entrance restrictions, the local economy would lose these potential visitors' local-area expenditures.

It is estimated that a loss of the regional expenditures by these nonresidents would lead to an overall reduction of between $9,500,000 and $12,300,000 in total economic output and between 230 and 299 jobs in the 3-state area. This is a negligible negative impact in the context of the regional 3-state economy. This estimated reduction would be lessened to the extent that nonresidents would choose to recreate at other locations within the 3-state region instead of in the GYA. The extent of any such substitution behavior is unknown.

Town of West Yellowstone. The FEIS provided estimates of output and employment impacts on both the 5-county GYA area and the 3-state region. The SEIS presents impacts on the gateway community of West Yellowstone, MT in addition to the 5-county and 3-state estimates. Overall, the direct spending impacts associated with alternative 3 are estimated to be approximately 45% of the impacts associated with the 5-county area. The total expenditure impacts for West Yellowstone will be a smaller percentage of the 5-county total impacts (that is, smaller than 45%) because West Yellowstone likely has a significantly smaller expenditure multiplier than the 1.60 multiplier derived for the 5-county area.

Based on available information and survey data it appears that, consistent with the conclusions in the FEIS, a majority of the 5-county impacts would be felt by the local West Yellowstone economy. Further, the output and employment impacts on West Yellowstone would represent a much larger percentage of total annual economic activity than did the estimated impacts for the larger, more economically diverse 5-county area.

Social Values. Most winter visitors surveyed support mechanized access to the parks. In the context of overall access to the park, the changes proposed in alternative 3 are likely to result in moderate to major local adverse impacts by limiting use to 330 snowmobiles per day at the West Entrance. Conversely, a portion of winter users favor reductions in motorized use within the park. For this group the alternative 3 travel restrictions would have a positive impact.

The current winter visitors to YNP are those who are attracted by the current set of opportunities, which include snowmobiling. These visitors support the past policy. Among summer visitors (as detailed in Chapter III of the FEIS), there is less support for the past policy of allowing snowmobiles. Among the general public, local residents are evenly divided between the existing and past policies. However, this probably varies by county. For

example, the Teton County, WY survey (discussed in Chapter III of the FEIS) found a much higher overall participation among locals in cross-country skiing (mostly in GTNP) than snowmobiling. A majority of local residents feel that snowmobiles negatively impact Yellowstone in the winter and that snowmobiles should be limited in YNP in winter. Among the regional and national populations a plurality of respondents favor the snowcoach option over the past policy. For this group, alternative 3 would be more positive than alternative 2.

The potential for a shift in the type of winter recreation activity supported by YNP is indicated by relative participation rates. For example, nationally, regionally and locally cross-country skiing is just as, or slightly more, popular than snowmobiling.

Nonmarket Values. Alternative 3 potentially would impact nonmarket values of winter visitors through a reduction in current winter user visitation resulting from the restriction of mechanized travel to clean, quiet snowcoaches.

Based on the winter visitor survey, the nonmarket value of a trip to GYA parks is $91. It is estimated that park visitation would be reduced by between 13.6% and 17.6% resulting from the alternative. Based on current winter visitation levels, these estimated reductions in visitation would translate into between a $1,200,000 and $1,550,000 reduction in the aggregate nonmarket value of winter trips to the parks. This is a minor adverse impact. These estimates are based on reduced use by current visitors.

Conclusion

Alternative 3 management actions would have a negligible to minor negative impact on the 5-county economy and a negligible negative effect on the 3-state economy through changes in visitation and nonresident visitor expenditures. Alternative 3 also would have a minor negative impact on total current trip nonmarket visitor benefits (through reduced visitation). The changes proposed in alternative 3 are likely to result in minor to moderate local adverse impacts to some visitors' social values and a minor to moderate positive impact on other users' social values.

THE EFFECTS OF IMPLEMENTING THE ALTERNATIVES ON PUBLIC HEALTH AND SAFETY

Methods

The following types of information were used to assess the level of impacts on public safety:

- Case Incident Reports (CIRs): These reports are filed when rangers are summoned to a specific location. For YNP, CIRs related to winter use were compiled and the number of CIRs per recreation type was computed for the December 1995 to April 2001 winter seasons (Wondrak 1998, rev. 1999, 2000, and 2001). For GTNP and the Parkway, information related to CIRs was obtained from park dispatch.
- Emergency Medical Services (EMS) Reports: These reports are filed when rangers assist in medical emergencies. For YNP, EMS reports related to winter use were compiled and the number of reports per recreation type was computed for the December 1995 to April 2001 winter seasons (Wondrak 1998, rev. 1999, 2000, and 2001). For GTNP and the Parkway, information related to EMS reports was obtained from park dispatch.
- Motor Vehicle Accidents (MVA) Reports: For YNP, information was obtained from a report that detailed the number and type of MVAs that occurred in the winter use seasons from December 1995 to April 2001 (Wondrak 1998, rev. 1999, 2000, and 2001). Accidents that occurred on US Highway 191 were excluded. For GTNP and the Parkway, information related to MVAs was obtained from park dispatch. Accidents that occurred on US Highway 191/26/89 south of Moran Junction were excluded.
- Citations: For YNP, information was obtained from a report that detailed the number and type of citations that were issued by rangers in the winter use seasons from December 1995 to April 2001 (Wondrak 1998, rev. 1999, 2000, and 2001). Citations issued on US Highway 191 were excluded. For GTNP and the Parkway, information related to citations was obtained from park dispatch.

Chapter III of this document describes in detail the above reports.

The information used to assess the level of impacts on public health is contained in the analysis of air quality impacts relative to National Ambient Air Quality Standards. The standards for NAAQS pollutants are predicated on the level of pollution deemed under the law to be harmful to those with respiratory illnesses or are otherwise susceptible to pollutants.

Table 36. Definition of impacts to public health and safety.

Impact Category	Definition
Negligible Effect	The impact to public health and safety is not noticeable or perceptible.
Minor Effect	The impact to public health and safety is measurable or perceptible, and is limited to a relatively small number of winter use visitors at localized times.

Impact Category	Definition
	Impacts to public safety may be realized through a minor increase or decrease in the potential for visitor conflicts in current accident areas. Impacts to public health are interpreted as of low risk to public health because NAAQS are never exceeded, but may be approached in few local areas.
Moderate Effect	The impact to public health and safety is sufficient to cause a permanent change in accident rates at existing low accident locations or create the potential for additional visitor conflicts in areas that currently do not exhibit noticeable visitor conflict trends. Impacts to public health are interpreted as of moderate risk to public health because NAAQS are regularly approached, and may be exceeded occasionally at peak use times in local areas.
Major Effect	The impact to public safety is substantial either through the elimination of potential hazards or the creation of new areas with a high potential for serious accidents or hazards. Impacts to public health are interpreted as a major risk to public health because NAAQS are regularly exceeded in local areas.

The Effects of Implementing Alternative 1a on Public Health and Safety

Under alternative 1a, late night oversnow travel would be prohibited from 9:00 P.M. to 8:00 A.M. in all three parks. This action would eliminate any potential for collisions during those hours between oversnow motorized vehicles and wildlife (although the effect of this action would be negligible because less than 1% of recorded accidents during the last three years have occurred in the time period from 11 P.M. to 5 A.M). The primary benefit to public safety would be that all potential for snowmobile accidents, as well as snowmobile/snowcoach conflicts, would be removed. Also, because snowcoach drivers generally have more familiarity with the roads and wildlife patterns than the casual visitor, the elimination of private snowmobiles would reduce the overall potential for accidents (snowcoaches are involved in less than 3% of accidents). In addition, this alternative eliminates the potential for inter-modal conflicts between different types of oversnow motorized vehicles and facilitates nightly grooming, which is also a benefit to safety.

Because large numbers of snowmobiles would not be staged at park entrances, effects to public health related to high levels of NAAQS pollutants would be virtually nonexistent.

In GTNP closing the road between Colter Bay and Flagg Ranch to wheeled-vehicles (starting the winter of 2008-2009) would eliminate the potential for inter-modal conflict along this stretch of the CDST. It would eliminate a major source of winter vehicle accidents, vehicle-wildlife accidents and unsafe vehicular activity. Elimination of snowmobiles from the surface of Jackson Lake would also eliminate the potential for accidents involving poor ice on the lake's frozen surface.

Conclusion

Conclusions described in the FEIS on page 413 remain valid. The benefits of implementing this alternative would be beneficial, major and long term due to the elimination of all potential snowmobile accidents in the three parks. High levels of NAAQS pollutants would not be not likely to occur, therefore members of the public who are susceptible to respiratory problems would not be affected. Associated effects would be none to negligible (also see *Effects of Implementing the Alternatives on Air Quality*).

The Effects of Implementing Alternative 1b on Public Health and Safety

All effects described under alternative 1a remain unchanged. The principal difference between alternatives 1a and 1b is that under alternate 1b, implementation would be delayed one year. Consequently, snowmobiles would be phased out by 50% beginning 2003-2004, and beginning 2004-2005 access would be limited to snowcoaches only. Therefore the beneficial effects of the alternatives would be delayed one year.

The Effects of Implementing Alternative 2 on Public Health and Safety

Nighttime oversnow travel would be prohibited from 8:00 P.M. to 7:30 A.M. (8:30 A.M. for snowmobiles through the West Entrance). This action would reduce the potential for nighttime collisions. Despite the more restrictive travel hours relative to alternative 1a, effects related to collisions would increase due to the presence of snowmobiles (which account for 97% of all oversnow-related accidents in the parks). Although rare, accidents on the CDST would continue to occur, and due to automobiles and snowmobiles traveling in close proximity, safety on this route would remain a concern, as would the poor condition of some of the groomed routes. Snowmobile access on Jackson Lake would be permitted, and hazards associated with that activity would be present. To mitigate the potential for accidents, this alternative would lower the speed limit to 35 mph from the West Entrance to Old Faithful and would increase ranger patrols to strictly enforce speed limits and other travel regulations. Furthermore, visitor safety would be discussed at optional orientation briefings held in the gateway communities.

Visitor exposure to exhaust and sound would continue, although cleaner and quieter technology would help to mitigate this exposure. Other mitigation measures include removing the peak days from the West Entrance and requiring pre-paid entrance permits. An increase in use levels at other gates may increase visitor exposure at those entrances to snowmobile exhaust and sound.

Conclusion

Adverse effects on public safety would be increased relative to alternative 1a due to the presence of snowmobiles. Alternative 2 would result in minor adverse impacts to visitor and employee safety along the road from West Yellowstone to Old Faithful and along the CDST, and negligible adverse impacts on less heavily traveled routes. Safety concerns for winter visitors who utilize the East Entrance would be minor to moderate and adverse.

Where high levels of NAAQS pollutants occur, visitors who are susceptible to respiratory problems would likely be adversely and moderately affected. High levels occur at times and places where large numbers of oversnow vehicles stage for entry into the parks, and pose the most problem at the West Entrance to YNP. Cleaner machines would result in fewer effects than currently, but increased numbers of snowmobiles may offset any gained benefits (also see *Effects of Implementing the Alternatives on Air Quality*).

The Effects of Implementing Alternative 3 on Public Health and Safety

Similar to alternative 2, effects on public safety would be increased relative to alternative 1a due to the presence of snowmobiles. However, under alternative 3, snowmobiles would be fewer in number and use would be distributed to alleviate congestion along the more popular routes. Consequently, the potential for accidents would potentially decrease relative to alternative 2. The elimination of snowmobiles on Jackson Lake and the shared automobile/snowmobile traffic from Colter Bay to Flagg Ranch would also serve to increase public safety. The requirement that a permitted guide must accompany snowmobilers in YNP would enhance safety through increased adherence to speed limits and other travel regulations, as would the prohibition on late night travel from 8:00 P.M. to 7:30 A. M.

Cleaner and quieter technology enforced through concession contracts and reduced snowmobile numbers would reduce visitor exposure to pollutants and sound.

Conclusion

Alternative 3 would result in negligible to minor adverse impacts to visitor safety along the road from West Yellowstone to Old Faithful. Safety would be increased on the CDST due to the elimination of the shared corridor from Colter Bay to Flagg Ranch, and effects would be negligible and adverse along this route. Safety concerns for winter visitors who utilize the East Entrance would be minor to moderate and adverse. Where high levels of NAAQS pollutants occur, visitors who are susceptible to respiratory problems would likely be

adversely and moderately affected but to a lesser degree than alternative 2 (also see *Effects of Implementing the Alternatives on Air Quality*).

THE EFFECTS OF IMPLEMENTING THE ALTERNATIVES ON EMPLOYEE HEALTH AND SAFETY

Methods

To assess the level of impact to employee health and safety under each alternative, the following types of information were used:

- Reports from employees and commercial guides;
- Reports submitted to NPS from OSHA (Occupational Safety and Health Administration) and NIOSH (National Institute for Occupational Safety and Health) documenting the hazards to employees from working with the current mix of winter transportation in YNP;
- Results of air monitoring near the West Entrance in YNP; and
- A review of infractions that are associated with unsafe snowmobiling behaviors; and
- Anecdotal reports by employees related to observed unsafe snowmobiling behaviors.

Table 37. Definition of impacts to employee health and safety.

Impact Category	Definition
Negligible Effect	The impact to employee health and safety is not noticeable or perceptible.
Minor Effect	The impact to employee health and safety is measurable or perceptible, and is limited to a relatively small number of winter use visitors at localized times. Impacts to employee safety may be realized through a minor increase or decrease in the potential for visitor conflicts in current accident areas. Impacts to employee health are interpreted as of low risk if NAAQS are never exceeded, but are approached infrequently in few local work areas.
Moderate Effect	The impact to employee health and safety is sufficient to cause a permanent change in accident rates at existing low accident locations or create the potential for additional visitor conflicts in areas that currently do not exhibit noticeable visitor conflict trends. Impacts to employee health are interpreted as of moderate risk because NAAQS are regularly approached, and may be exceeded occasionally at peak use times where employees live or work.
Major Effect	The impact to employee safety is substantial either through the elimination of potential hazards or the creation of new areas with a high potential for serious accidents or hazards. Impacts to employee health are interpreted as a major risk because NAAQS are regularly exceeded where employees live or work.

The Effects of Implementing Alternative 1a on Employee Health and Safety

A reduced number of vehicles (snowcoaches only) would be entering through the West Entrance, consequently rangers would not have to patrol outside of the booth to check for underage drivers and valid passes. Therefore, exposure to pollutants and sound at the West Entrance would be significantly reduced. Additionally, fewer numbers of oversnow vehicles on the roads would help to maintain a smoother road surface and reduce the number of needed ranger patrols. This would minimize injures to employees caused by the jarring of a bumpy road surface. Employees would also not be exposed to unsafe operation of snowmobiles.

The East Entrance would remain open, therefore employees would still be exposed to the hazards of avalanche control.

Conclusion

The benefits of implementing this alternative would be beneficial, moderate and long term due to the elimination of all potential snowmobile accidents in the three parks. Avalanche control operations would continue to pose adverse, major threats to employee safety at the East Entrance of YNP. Effects related to high levels of NAAQS pollutants would be negligible. Employees who are susceptible to respiratory problems would not likely be affected by this alternative. Relative to the existing condition, there would be a moderate beneficial long term impact in reducing pollutants (also see *Effects of Implementing the Alternatives on Air Quality*).

The Effects of Implementing Alternative 1b on Employee Health and Safety

All effects described under alternative 1a remain unchanged. The principal difference between alternatives 1a and 1b is that under alternate 1b, implementation would be delayed one year. Consequently, snowmobiles would be phased out by 50% beginning 2003-2004, and beginning 2004-2005 access would be limited to snowcoaches only.

The Effects of Implementing Alternative 2 on Employee Health and Safety

Snowmobiling would continue in this alternative at levels similar to current use. Although peak days would not occur at the West Entrance, other entrances would have increased use levels. Because NPS would be required to enforce the cleaner and quieter technology requirement thereby requiring law enforcement to monitor snowmobiles entering the gates, employee exposure to exhaust and sound would continue. Cleaner and quieter technology would help to mitigate this exposure. Removing the peak days from the West Entrance and

requiring pre-paid entrance permits would also partly mitigate entrance staff exposure to pollutants and sound at this gate. An increase in use levels at other gates will add to the time employees at those entrances are exposed to snowmobile exhaust and sound. Due to the number of snowmobiles, road bumps are still likely to appear on most routes. Because this alternative entails an increase in ranger patrol, the risk of injuries due to the jarring of the bumpy roads would increase. Employees would continue to be exposed to unsafe operation of snowmobiles, however the increased ranger presence, slower speed limit, prohibition on late night travel, and the optional visitor orientation program would reduce this hazard.

The East Entrance would remain open, so employees would still be exposed to the hazards of avalanche control.

Conclusion

Because snowmobiles would be allowed in the parks, effects would increase relative to alternative 1a. Effects would be adverse and minor from the West Entrance to Old Faithful and on the CDST, and adverse and negligible on the less heavily traveled routes in the parks.

Adverse effects associated with avalanche control would be the same as alternative 1a.

Unsafe snowmobiling practices would continue to pose adverse, moderate effects to park employees. Increased ranger patrols, slower speed limits and a prohibition on late night travel may mitigate these effects.

For employees who patrol/work on high-traffic, bumpy roads, effects would be adverse and moderate.

Where high levels of NAAQS pollutants occur, employees who are susceptible to respiratory problems would likely be adversely affected. Overall impacts would be minor to moderate. High levels occur at times and places where large numbers of oversnow vehicles stage for entry into the parks. Cleaner machines would result in fewer effects than currently, but increased numbers of snowmobiles may offset any gained benefits. As the number of snowmobiles are reduced through the phase-in period, this impact would decline (see *Effects of Implementing the Alternatives on Air Quality*).

Effects to employee hearing would be adverse and minor due to quieter machines.

The Effects of Implementing Alternative 3 on Employee Health and Safety

Cleaner and quieter technology enforced through concession contracts and reduced snowmobile numbers would reduce the need for monitoring at the gate. Employee exposure

to pollutants and sound would be minimized. Snowmobile numbers would be low enough to minimize poor road conditions and the jarring effect. Education through guides and the lower snowmobile numbers would also greatly minimize employee exposure to unsafe snowmobile operation.

The East Entrance would remain open, so employees would still be exposed to the hazards of avalanche control.

Conclusion

Because snowmobiles would be allowed in the parks under alternative 3, effects would increase relative to alternative 1a. From the West Entrance to Old Faithful, effects would be adverse and negligible to minor. On the CDST from Colter Bay to Flagg Ranch, effects would be beneficial due to the elimination of the shared corridor. Effects may be mitigated by the prohibition on late night travel, reduced snowmobile numbers, and a reduction in snowmobile numbers.

Adverse effects associated with avalanche control would be the same as alternative 1a.

Effects related to unsafe snowmobiling practices would be none to negligible due to the mandatory use of permitted guides and the mitigation measures discussed above.

Where high levels of NAAQS pollutants occur, employees who are susceptible to respiratory problems would likely be adversely affected (although to a lesser degree than alternative 2). Overall levels of impact would be minor to moderate (also see *Effects of Implementing the Alternatives on Air Quality*).

THE EFFECTS OF IMPLEMENTING THE ALTERNATIVES ON AIR QUALITY AND AIR QUALITY RELATED VALUES

The focus of analysis in this draft SEIS is on modeled production of emissions from recreational, oversnow motorized vehicles for each alternative. There has not been sufficient time available to date in which to complete the modeling of visibility impacts or to complete a PSD (prevention of significant deterioration) increment analysis recommended by the EPA. Both analyses are viewed by NPS as important in disclosing impacts on air quality. These analyses will be incorporated into the final SEIS.

Summary of Changes in Impacts Between FEIS and SEIS

Specific impact estimates were calculated for the SEIS alternatives, corresponding to estimates for seven alternatives evaluated in the FEIS. For purposes of comparison SEIS

estimates are displayed below along with modeled results from alternatives A, B and D from the FEIS. Alternative A represents existing conditions and management, prior to implementation of the current decision. Alternatives B and D both prescribed objectives for cleaner snowmobiles to address issues relating to air quality.

Table 38: Modeled air quality impacts for SEIS alternatives compared to selected FEIS alternatives.

SEIS and FEIS Alternatives	Analysis Area	1-Hr CO (ppm)	Δ in CO from Existing	24-hour PM_{10} (μgrams/$m^{3)}$	Δ in PM_{10} from Existing
FEIS Alternative A (Existing Condition - prior to implementing the current decision)	West Yellowstone: West Entrance to Madison Flagg Ranch	32.2 14.8 4.72	0% 0% 0%	68.2 33.7 6.0	0% 0% 0%
SEIS Alternatives 1a and 1b (after full implementation)	West Yellowstone: West Entrance to Madison Flagg Ranch	4.5 1.15 2.0	-86% -92% -58%	23.4 5.4 5.17	-66% -84% -14%
SEIS Alternative 2 (after year 3 at full implementation)	West Yellowstone: West Entrance to Madison Flagg Ranch	7.9 2.4 1.55	-75% -84% -45%	40.9 12.0 2.3	-40% -19% -51%
SEIS Alternative 3 (after year 2 at full implementation)	West Yellowstone: West Entrance to Madison Flagg Ranch	5.8 1.45 0.77	-82% -90% -84%	24.6 5.4 5.04	-64% -84% -16%
FEIS Alternative B (by 2008-2009)	West Yellowstone: West Entrance to Madison Flagg Ranch	6.3 3.7 4.19	-80% -75% -11%	23.6 23.6 5.18	-65% -30% -14%
FEIS Alternative D (by 2008-2009)	West Yellowstone: West Entrance to Madison Flagg Ranch	20.6 10.1 4.08	-36% -32% -14%	34.7 25.8 5.22	-49% -23% -13%

Methods and Assumptions

In order to assess the relative impacts of the proposed winter use alternatives on ambient air quality in the GYA, short term air quality analyses were performed by means of atmospheric dispersion modeling for carbon monoxide (CO) and particulate matter (PM_{10}). The

alternatives that are identified in this document are summarized in the following section. In addition to the air quality modeling, the winter season total mobile emissions of CO, PM_{10}, nitrogen oxides (NO_X), and hydrocarbons (HCs) inside the park units were calculated for each scenario and vehicle type.

Alternatives - Review and Assumptions Relevant to Modeling

Alternative 1a, No Action, is the same as the current decision. In terms of final implementation, it is the same as Alternative 1b, which would delay implementation by one year. Alternative 1b is addressed in detail below.

Under alternative 1b, only snowcoaches would travel in the three park units beginning in the 2004-2005 winter season. Because this alternative is essentially the same as alternative G (the Preferred Alternative presented in the FEIS) the snowcoach emission factors analyzed were also the same. Estimated snowcoach use levels are presented in Appendix A of the HMMH noise analysis report. The full implementation season of alternative 2 is year 3 (2004 – 2005 winter season). Year 1 (2002 – 2003 winter season) is characterized by the existing use, and year 2 is characterized by a 50% reduction in snowmobile entries at the West Yellowstone Entrance.

Alternative 2 contains several scenarios to accommodate the phase-in schedule for different vehicle types. For rental and outfitter snowmobiles (70% of existing snowmobile fleet use) from year 1 (2002-2003 winter season) forward, only 4-stroke engine snowmobiles and other models whose engine family meets an emission standard of 200 g/kW-hr (149 g/hp-hr) for CO and 75 g/kW-hr (56 g/hp-hr) for hydrocarbons (HC) would be allowed in the park units. This represents the proposed 2010 U.S. Environmental Protection Agency (EPA) emission rule for snowmobiles and constitutes a 50% reduction over current snowmobile emissions (Federal Register 2001). The proposed rule also notes that "limits on HC emissions will serve to simultaneously limit PM_{10}."

For public snowmobiles (30% of the snowmobile fleet) for years 1 and 2 (2002-2003 and 2003-2004 winter seasons), only 4-stroke snowmobiles and 2-stroke engine models using Bio-Base Fuels (10% ethanol blend fuel and full synthetic low-emission oil) would be allowed in the park units. For year 3 (2004-2005 winter season) and beyond, only 4-stroke snowmobiles and other models whose engine

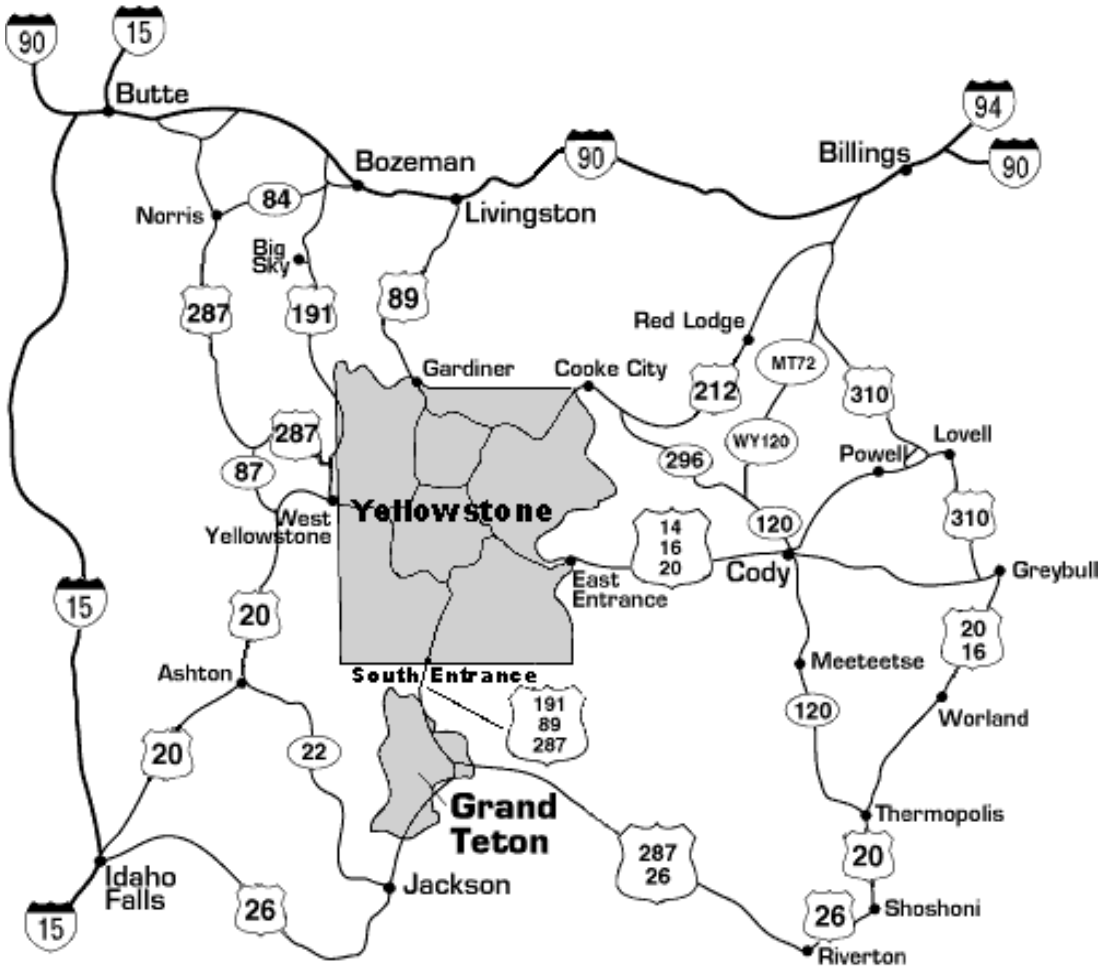

Figure 7. Greater Yellowstone Area.

family meets an emission standard of 200 g/kW-hr (149 g/hp-hr) for CO and 75 g/kW-hr (56 g/hp-hr) for HC (proposed 2010 EPA emission rule for snowmobiles) would be allowed in the park. The full implementation date of alternative 2 is in year 3 (2004 – 2005 winter season), and years 1 and 2 (2002 – 2003 and 2003 – 2004 winter seasons) are characterized by the existing use except snowmobile use.

Under alternative 3, new cleaner and quieter snowmachine technologies would be required for all recreational oversnow vehicles entering the parks. NPS would implement this requirement through the issuance of outfitter and guide permits. Interim or initial emission and sound requirements would be based on best available technology and evaluated annually under an adaptive management framework. The yearly evaluation would result in an adjustment of snowmobile use limits if necessary for protection of air quality, wildlife, visitor experience, and natural soundscapes as defined by NPS policy and determined by

monitoring. The snowmobile emission factors under alternative 2 were derived from new Arctic Cat® 4-stroke snowmobile engine test data. The vehicle use levels are presented in Appendix A. The full implementation date of alternative 2 is year 2 (2003 – 2004 winter season), and year 1 (2002–2003 winter season) is characterized by the existing use.

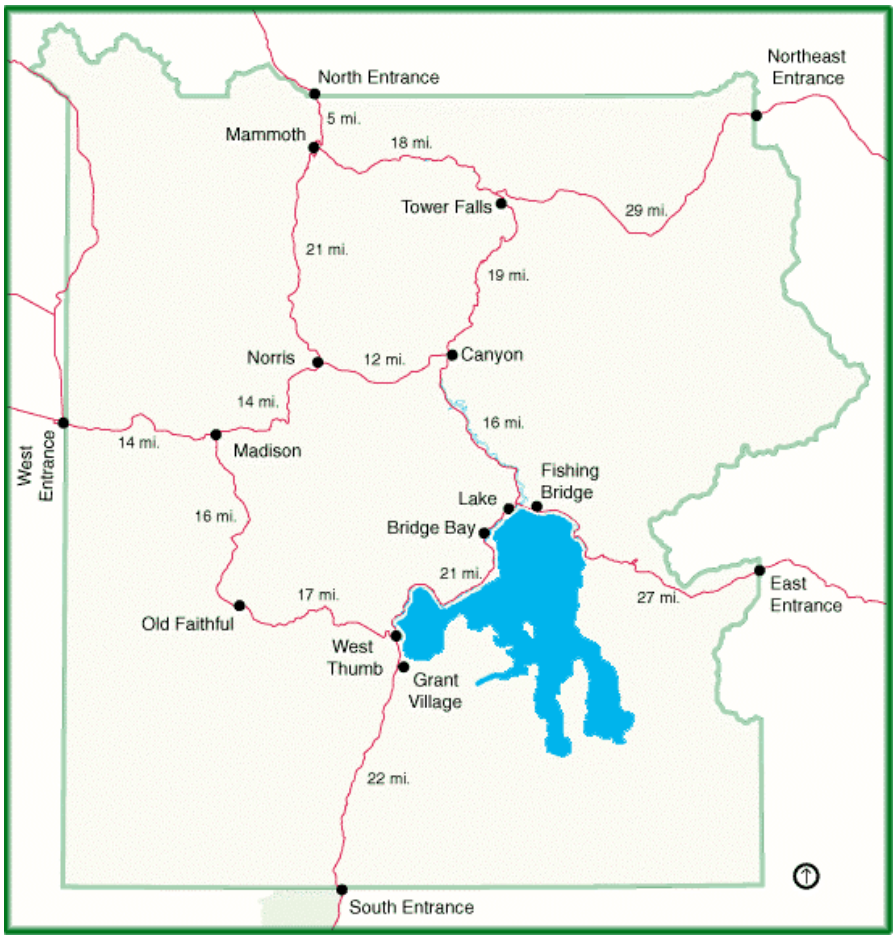

Figure 8. Yellowstone National Park.

Air Quality Modeling Inputs

Modeling Locations and Procedures

Figure 7 notes the general park areas, and Figure 8 notes some of the areas of interest in Yellowstone National Park. Six locations noted in Table 39 were selected for the air quality modeling analyses based on their characteristics and vehicle mix by alternative. Prior to initiating the air quality modeling, a modeling protocol was prepared (EA 2001). As noted in the protocol, for each alternative, the worst-case maximum ambient concentrations of carbon monoxide (CO) and particulate matter (PM_{10}) were estimated using EPA-approved

air quality models for four pre-defined vehicle fleets operating in six locations. For the West Yellowstone Entrance and the roadway links, the EPA model CAL3QHC (EPA 1995a) was used to predict the worst-case maximum 1-hr average concentrations of CO and PM_{10}.

Table 39. Selected locations for modeling application and vehicle mix by alternative.

Location	Type	Vehicle Mix		
		Alternatives 1a & 1b	Alternative 2	Alternative 3
West Yellowstone Entrance Station	Fee Collection Booths	Snowcoach travel only	Snowcoach and snowmobile travel only	Snowcoach and snowmobile travel only
Old Faithful	Staging Area	Snowcoach travel only	Snowcoach and snowmobile travel only	Snowcoach and snowmobile travel only
Flagg Ranch	Staging Area	Snowcoach travel only	Snowcoach and snowmobile travel only	Snowcoach and snowmobile travel only
Mammoth to Northeast Entrance	Plowed Highway	Wheeled vehicle travel only	Wheeled vehicle travel only	Wheeled vehicle travel only
West Entrance to Madison	Groomed Motorized Route	Snowcoach travel only	Snowcoach and snowmobile travel only	Snowcoach and snowmobile travel only
Flagg Ranch to Colter Bay	Groomed Motorized Trail/Plowed Road	Snowcoach travel only	Snowcoach and snowmobile travel only	Snowcoach and snowmobile travel only

Furthermore, persistence factors (0.7 for 8-hr average and 0.4 for 24-hr average) were applied to the maximum 1-hr average concentrations to calculate the maximum 8-hr average CO concentrations and 24-hr average PM_{10} concentrations. For the staging areas, the EPA model ISCST3 (EPA 1995b) was used to predict the maximum 1-hr and 8-hr average CO concentrations and maximum 24-hr average PM_{10} concentrations.

The predicted maximum concentrations of CO and PM_{10} imparted to traffic conditions of the proposed alternatives were then compared to those of the full implementation scenario of alternative 2 (i.e., year 3 2004 -2005) in order to determine the amount and direction of changes in maximum CO and PM_{10} concentrations. The contribution of each vehicle type to the generation of CO and PM_{10} also was assessed for each scenario.

Emission Factors

A composite running emission factor in grams per vehicle-mile for each free flow link and an idle emission factor in grams per vehicle-hour for each queue link and for the staging areas were required. For the full implementation of alternative 1b (2004-2005 winter season), the snowcoach emission factors were obtained from the Preferred Alternative of the FEIS. They represented the emission factors of model year 2000 light duty gasoline trucks (LDGT) and are summarized in Table 40.

Table 40. Snowcoach emission factors used in alternative 1a year 3 and beyond.

Vehicle Type	Traveling Emission Factor (g/mile)		Idle Emission Factor (g/hr)	
	CO	PM_{10}	CO	PM_{10}
2000 LDGT (at 10 mph)	109.9	0.073	487	NA
2000 LDGT (at 35 mph)	67.52	0.055	487	NA

For the rental and outfitter snowmobiles in alternative 2, the snowmobile emission factors for HC and CO were derived from the proposed 2010 EPA snowmobile emission rule, while that for NOx was derived from the EPA NONROAD model (EPA 2000) emission factor, and that for PM_{10} was assumed to be 50% of the NONROAD factor. For the public snowmobiles with 2-stroke engines using bio-base fuel and synthetic oil, the snowmobile emission factors for all pollutants were derived from the NONROAD 2-stroke snowmobile emission factors. In year 2, the snowmobile emissions for HC and CO were derived from the proposed 2010 EPA snowmobile emission rule. Note that the 50% reduction in PM_{10} emission factors assumed for some scenarios are based on the assumption that PM_{10} emissions will decrease in a manner directly proportional to HC. These emission factors are presented in Tables 41 and 42.

Table 41. Snowmobile traveling emission factors for alternatives 2 and 3.

Alternative	YEAR	User	Composite Emission Factor (g/hp-hr)			
			HC	NO_X	CO	PM_{10}
2	2002-2005	Rentals and Outfitters	56[1]	3.497[3]	149[1]	1.3 5[5]
		General Public	110[3]	0.86[3]	300[3]	2.7[3]
	2005-2006 and later	All	56[1]	3.497[2]	149[1]	1.3 5[5]
3	2003-2004 and later	All	4.71[4]	14.32[4]	50.86[4]	0.06[2]

1 EPA 2010 snowmobile emission factor proposal
2 EPA Nonroad 4-stroke snowmobile NO_X and PM_{10} emission factor
3 EPA Nonroad 2-stroke snowmobile emission factor
4 Arctic Cat® 4-stroke prototype snowmobile emission factor
5 50% decrease of the existing 2-stroke level assumed

Table 42. Snowmobile idle emission factors used for Alternatives 2 and 3.

Alternative	Year	User	Idle Emission Factor (g/hr)			
			HC	NO_X	CO	PM_{10}
2	2002-2005	Rentals and Outfitters	403[1]	0.15[1]	258[1]	2.05[1]
		General Public	806[2]	0.3[2]	516[3]	4.10[3]
	2005-2006 and later	All	403[1]	0.15[1]	258[1]	2.05[1]
3	2003-2004 and later	All	10[4]	0.65[4]	29[4]	0.09[5]

1 50 percent decrease of the existing 2-stroke level assumed
2 SWRI 1999 2-stroke Polaris baseline
3 As used in the FEIS, derived from SWRI 2-stroke snowmobile test (1999)
4 Arctic Cat® 4-stroke prototype
5 Surrogate idle obtained by applying the PM_{10} composite emission factor ratio of the existing condition (2.7 g/hp-hr - Nonroad 2-stroke) to the Arctic Cat® composite emission factor (0.06 g/hp-hr - Nonroad 4-stroke) to the existing 2-stroke idle emission factor (4.1 g/hr). (0.06 g/hp-hr / 2.7 g/hp-hr)*4.1 g/hr = 0.09 g/hr.

For alternative 3, the snowmobile CO and HC emission factors were based on the latest Arctic Cat® 4-stroke snowmobile engine emissions test data, and the PM_{10} emission factor was derived from the EPA Nonroad 4-stroke snowmobile PM_{10} emission factors. These snowmobile emission factors also are presented in Tables 41 and 42 Since the snowmobile traveling emission factors are expressed in g/hp-hr, a conversion to g/mile was necessary. This was done using the following formula:

(g/mile) = (g/hp-hr) x (weighted average load) x (load factor) / (vehicle speed)

The weighted average load is 48 hp for 2-stroke engine, the weighted average of the EPA Nonroad snowmobile population for Wyoming and Montana, and 45 hp for 4-stroke engines (Arctic Cat® data). A load factor of 0.34 also was assumed (EPA 2000c). The snowmobile idle emission factors were obtained directly from the mode 5 emission factor values of the snowmobile engine test mentioned in Tables 41 and 42. Moreover, calculated results from these data area conservative because deterioration rates were not applied to the emission factors in the present study because there were no applicable data available for snowmobiles or snowcoaches.

The wheeled vehicles emission factors were obtained from the FEIS and are summarized in Table 43. The traveling emission factors for CO were estimated from AP-42 Volume II (EPA, 1998), and the traveling emission factors for PM_{10} were estimated from the EPA emission factor model PART5 (EPA 1995c). The idle emission factors were derived from the idling vehicle emissions publications (EPA 1998). Since gasoline-fueled vehicle idle PM_{10} emissions are negligible, they were set to 0.001 g/hr in the modeling inputs.

Table 43. Wheeled vehicle emission factors.

Type	Traveling CO	Traveling PM_{10}	Traveling NOx	Traveling HC
	(g/mile) @ 35 mph			
Automobile	42.03	0.056	2.27	3.88
Light Truck	67.52	0.074	2.98	5.85
Heavy Truck	10.57	0.932	9.27	3.06
Tour Bus	10.57	0.778	1.17	0.51
Shuttle Van	67.52	0.074	2.98	5.85

Traffic Characteristics

Traffic counts from a February 2000 West Yellowstone Entrance monitoring project (NPS 2000a) indicated that the period between 9 A.M. and 10 A.M. represented the peak traffic hour and that on average 309 snowmobiles entered the park at that location during that time period. The average total daily entrance was 923 snowmobiles. This implies that approximately 33.5% of the snowmobiles entered the park during the peak hour. The winter motorized use scenarios indicate that the ratio of the average mean daily use to the average peak day use of snowmobiles is 0.57 for the existing conditions. Assuming that these percentages hold true for each alternative and each vehicle type, the peak hourly traffic volume (PHTV) may be calculated as PHTV = AMDU*0.33/0.57, where AMDU is the average mean daily use. For the West Yellowstone Entrance, PHTV would be multiplied by

the lane ratios (vehicles per lane/peak vehicle number). From the monitoring project data, these ratios are 0.22, 0.16, and 0.62 for lane 1, lane 2, and lane 3, respectively. For the staging areas, it was assumed that 20% of all vehicles are idling. The peak hourly traffic volumes for each vehicle type and for each alternative are presented in Appendix B of the draft air quality analysis report (EA 2001).

Videotapes recorded during the monitoring project indicated that the average idle time length is about 30 seconds and the average approach speed is about 10 mph for the West Yellowstone Entrance. Even though the third lane was designed to be free flowing, it was observed that, on average, motorists idle for a very short time of about five seconds. However, for alternative 1b, it was assumed that no express lane exists and that all lanes have the same idle time of 30 seconds. The average vehicle speed was 35 mph on the parks' roadways.

Meteorology

For the CAL3QHC modeling, meteorological conditions included low wind speed of 1.0 meter/second, stable atmosphere (class 6), and low mixing height of 50 meters. The latter was derived from the average morning mixing height data for the Jackson Hole Airport for the months of January and February 2000 (National Climatic Data Center data). The hourly surface and upper air meteorological data required by ISCT3 were processed from the Jackson Hole Airport data for the 1999 - 2000 winter months. A surface roughness of 283 cm representing a fir forest was selected. Furthermore, for PM_{10} modeling, a settling velocity and deposition velocity of 0.5 cm/s were selected (Zanneti 1990).

The ambient background concentrations of CO and PM_{10} were estimated following the guidelines of 40 CFR 51, Appendix W. For the West Entrance, the available monitoring data collected from January 12 to March 28, 1995 in the town of West Yellowstone (NPS 1996) were used. The background concentrations were estimated to be 3.0 ppm for the 1-hr average CO and 23.0 $\mu g/m^3$ for the 24-hr PM_{10}. The calculated 8-hr average CO background concentration is 2.10 ppm. For locations inside the park, the PM_{10} background concentrations at the staging areas were integrated from the Interagency Monitoring of Protected Visual Environments (IMPROVE) network aerosol data and were estimated to be 5.0 $\mu g/m^3$. However, since there are no CO monitors inside the parks, the ratio of the PM_{10} background concentrations at the West Entrance and inside the park was conservatively applied to the West Entrance CO background concentration to determine the inside-the-park

CO background concentration. This yielded 1-hr average and 8-hr average CO background concentrations of 0.65 ppm and 0.46 ppm, respectively, inside the park.

Direct and Indirect Effects of Implementing the Alternatives on Air Quality

West Yellowstone Entrance

The West Yellowstone Entrance is characterized by two fee collection booths where snowmobiles and snowcoaches idle when passing through. This creates stop-and-go, delay, and queuing traffic conditions. Also, an express lane exists at a third booth in which traffic is designed to be free flowing. To model the air quality impact of these traffic conditions, the EPA air quality model CAL3QHC was used. CAL3QHC predicts 1-hour average concentrations of inert pollutants from both moving and idling motor vehicles at roadway intersections. It includes the line source dispersion model CALINE3 (Benson, 1979) and a traffic algorithm for estimating vehicular queue lengths at signalized intersections. Even though the West Yellowstone Entrance is not a signalized intersection, it presents the characteristics of one (delay approach, idle, and acceleration).

CAL3QHC requires meteorological, site geometry, traffic, and emission parameters as critical inputs. A referential system with origin at the second fee collection booth was used to allocate the end points of the links and the receptor locations. Nine links representing the approach, queue, and departure links of each of the three lanes were defined. The end point coordinates of the links extend up to 1,000 ft for each link. Ten receptors were located outside the mixing zone, 200 feet apart along the northern and southern side of the entrance. The composite CO and PM_{10} peak hourly traveling and idle emission factors were calculated based on the emission factors presented in Tables 2 to 5. The composite CO and PM_{10} peak hourly traveling and idle emission factors and peak hourly vehicle uses are presented in Appendix B.

CO Concentrations

Tables 44 to 46 present the modeling results of the West Yellowstone Entrance for CO and for each Alternative. Table 44 shows the predicted maximum 1-hr average CO concentrations, and Table 45 shows the calculated maximum 8-hr average CO concentrations. The ratios of the maximum CO concentrations generated (i.e., without the background concentration) to the maximum CO concentration generated in the full implementation year of alternative 1a also are provided. The percent contributions of each vehicle type, including snowplows (heavy trucks), to the generation of CO are presented in Table 46.

Table 44. Maximum 1-hour average CO concentrations at the West Entrance.

Alternative	1-hr Maximum Concentration (w/o bkgd) (ppm)	1-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	29.20	32.2	19.47
Alt 1b Year 2	13.20	16.20	8.80
Alt 1b year 3 and beyond	1.50	4.50	1.00
Alt 2 year 1	11.73	14.73	7.82
Alt 2 year 2	8.75	11.75	5.84
Alt 2 year 3 and beyond	4.90	7.90	3.87
Alt 3 year 1	29.20	32.2	19.47
Alt 3 year 2 and beyond	2.80	5.80	1.87

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 45. Maximum 8-hour average CO concentrations at the West Entrance.

Alternative	8-hr Maximum Concentration (w/o bkgd) (ppm)	8-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	20.44	22.54	19.47
Alt 1b year 2	9.24	11.34	8.80
Alt 1b year 3 and beyond	1.05	3.15	1.00
Alt 2 year 1	8.21	10.31	7.82
Alt 2 year 2	6.13	8.23	5.84
Alt 2 year 3 and beyond	3.43	5.53	3.27
Alt 3 year 1	20.44	22.54	19.47
Alt 3 year 2 and beyond	1.96	4.06	1.87

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 46. Contributions to CO concentrations at the West Entrance.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	98.1	1.8	0.0	0.0	0.1	0.0	0.0
Alt 1b year 2	96.3	3.5	0.0	0.0	0.2	0.0	0.0
Alt 1b beyond year 3	0.0	98.6	0.0	0.0	1.4	0.0	0.0
Alt 2 year 1	98.2	1.6	0.0	0.0	0.2	0.0	0.0
Alt 2 year 2	97.7	2.1	0.0	0.0	0.3	0.0	0.0
Alt 2 beyond year 3	95.2	4.13	0.0	0.0	0.5	0.0	0.0
Alt 3 year 1	98.1	1.8	0.0	0.0	0.1	0.0	0.0

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 3 beyond year 2	63.0	35.8	0.0	0.0	1.2	0.0	0.0

All the generated maximum 1-hr average and 8-hr average CO concentrations for the alternative 2 and 3 scenarios are higher than those of the full implementation scenario of alternative 1b (year 3 and beyond). The full implementation scenario of alternative 3 (year 2 and beyond) performs better than the full implementation scenario of alternative 2 (year 3 and beyond). For example, the ratio of the maximum 1-hr average and 8-hr average CO concentrations to the maximum 1-hr average and 8-hr average CO concentrations generated in the full implementation year of alternative 1b is 1.87 for alternative 3 and 3.87 for alternative 2. year 1 of alternatives 2 and 3 represent the existing conditions and show concentrations 19.47 times higher than those of the full implementation scenario of alternative 1b (year 3 and beyond). years 2 and 3 of alternative 2 are similar to year 1 in term of technologies, but the numbers of snowmobiles at the West Entrance are different. year 2 of alternative 1b represents 50% of snowmobile use at the West and South Entrances of YNP.

Only the predicted 1-hr average CO concentration (with the background concentration) of the existing conditions (year 1 of Alternatives 1b and 3) exceeds the Montana Ambient Air Quality Standards (AAQS) for CO, which is 23 ppm, and none exceeded the National AAQS, which is 35 ppm. The predicted 8-hr average CO concentrations (with the background concentration) of the existing conditions (year 1 of alternatives 2 and 3), year 2 of alternative 1b and year 1 of alternative 2 exceed the National and Montana NAAQS for CO, which is 9 ppm. Furthermore, the contributions of snowmobiles are highest in the snowmobile-containing scenarios.

PM_{10} Concentrations

The predicted maximum 1-hr average concentrations of PM_{10} and the calculated maximum 24-hr average concentrations of PM_{10} are presented in Table 47 along with the ratios of maximum 24-hr average concentrations of PM_{10} for all scenarios of alternatives 2 and 3 and that of the full implementation scenario of alternative 1b. The percent contributions of each vehicle type, including groomers (heavy trucks), to the generation of PM_{10} are presented in Table 48.

Similar to the maximum CO concentration results, all the generated maximum 24-hr average PM_{10} concentrations for the alternative 2 and 3 scenarios are higher than those of the full implementation scenario of alternative 1b (year 3 and beyond). The full implementation scenario of alternative 3 (year 2 and beyond) performs markedly better than the full implementation scenario of alternative 2 (year 3 and beyond). For example, the ratio of the maximum 24-hr average PM_{10} concentrations to the maximum 24-hr average PM_{10} concentrations generated in the full implementation year of alternative 1b is 4.0 for alternative 3 and 22.0 for alternative 2. The existing conditions show concentrations 144 times higher than those of the full implementation scenario of alternative 1b (year 3 and beyond). None of the predicted 24-hr average PM_{10} concentrations (with the background concentration) exceeds the Montana or NAAQS for PM_{10}, which is 150 $\mu g/m^3$. Furthermore, the contributions of snowmobiles are highest in the snowmobile-containing scenarios.

Table 47. Maximum PM_{10} concentrations at the West Entrance.

Alternative	1-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/ bkgd) ($\mu g/m^3$)	Ratio Relative to 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	144.00	57.60	80.60	144.00
Alt 1b year 2	56.00	22.40	45.40	56.00
Alt 1b year 3 and beyond	1.00	0.40	23.40	1.00
Alt 2 year 1	111.8	44.72	67.72	111.8
Alt 2 year 2	79.5	31.8	54.8	79.5
Alt 2 year 3 and beyond	44.8	17.92	40.92	44.8
Alt 3 year 1	144.00	57.60	80.60	144.00
Alt 3 year 2 and beyond	4.00	1.60	24.60	4.00

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 48. Contributions to PM_{10} Concentrations at the West Entrance.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	99.3	0.2	0.0	0.0	0.5	0.0	0.0
Alt 1b year 2	98.7	0.4	0.0	0.0	0.9	0.0	0.0
Alt 1b beyond year 3	0.0	29.1	0.0	0.0	70.9	0.0	0.0
Alt 2 year 1	99.3	0.02	0.0	0.0	0.67	0.0	0.0
Alt 2 year 2	99.1	0.03	0.0	0.0	0.86	0.0	0.0
Alt 2 beyond year 3	98.3	0.07	0.0	0.0	1.59	0.0	0.0
Alt 3 year 1	99.3	0.2	0.0	0.0	0.5	0.0	0.0
Alt 3 beyond year 2	76.3	3.1	0.0	0.0	20.6	0.0	0.0

Roadway Segments

Similar to the West Yellowstone Entrance analysis, the road segments selected were modeled using CAL3QHC. When executed without a queue link, CAL3QHC behaves exactly like CALINE3, the recommended model for road segments. Receptors were located on both sides of the road segment links outside the mixing zone. The composite CO and PM_{10} peak hourly traveling emission factors were calculated based on the emission factors presented in Table 2 to 5 and they are presented in Appendix B of the air quality analysis report (EA 2001). The peak hourly vehicle uses also are presented in Appendix B.

West Yellowstone Entrance to Madison Junction Roadway Segment

The West Yellowstone Entrance to Madison Junction road segment is approximately 22 km long. The segment selected for modeling is a 16-km stretch of road starting approximately 8 km from the West Yellowstone Entrance. It was subdivided into 4 short links because of directional changes in the roadway.

CO Concentrations. Tables 49 to 52 present the modeling results of the West Yellowstone Entrance to Madison Junction road segment for CO and for each alternative. Table 48 shows the predicted maximum 1-hr average CO concentrations, and Table 12 shows the calculated maximum 8-hr average CO concentrations. The ratios of the maximum CO

concentrations generated (i.e., without the background concentration) to the maximum CO concentration generated in the full implementation year of alternative 1a also are provided. The percent contributions of each vehicle type, including groomers (heavy trucks), to the generation of CO are presented in Table 50.

Table 48. Maximum 1-hour Average CO concentrations at the West Entrance-Madison Junction roadway segment.

Alternative	1-hr Maximum Concentration (w/o bkgd) (ppm)	1-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	11.70	12.35	23.40
Alt 1b year 2	5.90	6.55	11.80
Alt 1b year 3 and beyond	0.50	1.15	1.00
Alt 2 year 1	3.61	4.26	7.22
Alt 2 year 2	2.84	3.49	5.68
Alt 2 year 3 and beyond	1.74	2.39	3.48
Alt 3 year 1	11.70	12.35	23.40
Alt 3 year 2 and beyond	0.80	1.45	1.60

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 49. Maximum 8-Hour average CO concentrations at the West Entrance-Madison Junction roadway segment.

Alternative	8-hr Maximum Concentration (w/o bkgd) (ppm)	8-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd))
Alt 1b year 1	8.19	8.65	23.40
Alt 1b year 2	4.13	4.59	11.80
Alt 1b year 3 and beyond	0.35	0.81	1.00
Alt 2 year 1	2.53	2.98	7.22
Alt 2 year 2	1.99	2.44	5.68
Alt 2 year 3 and beyond	1.22	1.67	3.48
Alt 3 year 1	8.19	8.65	23.40
Alt 3 year 2 and beyond	0.56	1.02	1.60

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 50. Contributions to CO concentrations at the West Entrance-Madison Junction roadway segment.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	98.7	1.3	0.0	0.0	0.0	0.0	0.0
Alt 1b year 2	97.4	2.5	0.0	0.0	0.1	0.0	0.0
Alt 1b beyond year 3	0.0	99.1	0.0	0.0	0.9	0.0	0.0
Alt 2 year 1	98.5	1.4	0.0	0.0	0.1	0.0	0.0
Alt 2 year 2	98.0	1.8	0.0	0.0	0.2	0.0	0.0
Alt 2 beyond year 3	96.0	3.7	0.0	0.0	0.3	0.0	0.0
Alt 3 year 1	98.7	1.3	0.0	0.0	0.0	0.0	0.0
Alt 3 beyond year 2	77.4	22.1	0.0	0.0	0.5	0.0	0.0

The results of West Entrance to Madison Junction roadway segment show the same trends as those of the West Yellowstone Entrance for CO, except that no standards are exceeded. All the generated maximum 1-hr average and 8-hr average CO concentrations for the alternative 2 and 3 scenarios are higher than those of the full implementation scenario of alternative 1b (year 3 and beyond). The full implementation scenario of alternative 3 (year 2 and beyond) performs better than the full implementation scenario of alternative 2 (year 3 and beyond). For example, the ratio of the maximum 1-hr average and 8-hr average CO concentrations to the maximum 1-hr average and 8-hr average CO concentrations generated in the full implementation year of alternative 1b is 1.60 for alternative 3 and 3.48 for alternative 2. Year 1 of alternatives 1b and 3 represent the existing conditions that show concentrations 23.40 times higher than those of the full implementation scenario of alternative 1b (year 3 and beyond). However, none of the predicted 1-hr average and 8-hr average CO concentrations (with the background concentration) exceeds the 1-hr average and 8-hr average CO concentrations of the Wyoming and National AAQS, respectively. Furthermore, the contributions of snowmobiles are highest in the snowmobile-containing scenarios.

PM_{10} Concentrations. The predicted maximum 1-hr average concentrations of PM_{10} and the calculated maximum 24-hr average concentrations of PM_{10} are presented in Table 51 along with the ratios of maximum 24-hr average concentrations of PM_{10} for all scenarios of alternatives 2 and 3 and that of the full implementation scenario of alternative 1b. The percent contributions of each vehicle type, including snowplows (heavy trucks), to the generation of PM_{10} are presented in Table 52.

Table 51. Maximum PM_{10} concentrations at the West Entrance-Madison Junction roadway segment.

Alternative	1-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/ bkgd) ($\mu g/m^3$)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd))
Alt 1b year 1	34.00	13.60	18.60	34.00
Alt 1b year 2	17.00	6.80	11.80	17.00
Alt 1b year 3 and beyond	1.00	0.40	5.40	1.00
Alt 2 year 1	34.7	13.88	18.88	34.7
Alt 2 year 2	28.1	11.24	16.24	28.1
Alt 2 year 3 and beyond	17.4	6.96	11.96	17.4
Alt 3 year 1	34.00	13.60	18.60	34.00
Alt 3 year 2 and beyond	1.00	0.40	5.40	1.00

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 52. Contributions to PM_{10} concentrations at the West Entrance-Madison Junction roadway segment.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	97.7	1.0	0.0	0.0	1.3	0.0	0.0
Alt 1b year 2	95.6	1.9	0.0	0.0	2.5	0.0	0.0
Alt 1b beyond year 3	0.0	50.5	0.0	0.0	49.5	0.0	0.0
Alt 2 year 1	98.66	0.13	0.0	0.0	1.21	0.0	0.0
Alt 2 year 2	98.28	0.16	0.0	0.0	1.56	0.0	0.0
Alt 2	96.76	0.34	0.0	0.0	2.80	0.0	0.0

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
beyond year 3							
Alt 3 year 1	97.7	1.0	0.0	0.0	1.3	0.0	0.0
Alt 3 beyond year 2	58.5	11.5	0.0	0.0	30.0	0.0	0.0

All the generated maximum 24-hr average PM_{10} concentrations for the alternative 2 and 3 scenarios are higher than those of the full implementation scenario of alternatives 1b (year 3 and beyond). The full implementation scenario of alternative 3 (year 2 and beyond) performs better than the full implementation scenario of alternative 2 (year 3 and beyond). For example, the ratio of the maximum 24-hr average PM_{10} concentrations to the maximum 24-hr average PM_{10} concentrations generated in the full implementation year of alternative 1b is 1.0 for alternative 3 and 17.4 for alternative 2. The existing conditions show concentrations 34 times higher than those of the full implementation scenario of alternative 1b (year 3 and beyond). None of the predicted 24-hr average PM_{10} concentrations (with the background concentration) exceeds the state or National AAQS for 24-hr average concentration of PM_{10}, which is 150 $\mu g/m^3$.

Flagg Ranch to Colter Bay Roadway Segment

The Flagg Ranch staging area to Colter Bay village road segment is approximately 21 km long. The segment selected for modeling is a 10-km stretch of the road starting approximately 11 km from Flagg Ranch. This road segment is characterized by an elevated groomed motorized trail for snowmobiles adjacent to a plowed highway. It was therefore subdivided into eight short links (four for the main road and four for the adjacent trail).

CO Concentrations. Tables 53 to 55 present the modeling results of the Flagg Ranch staging area to Colter Bay village road segment for CO and for each alternative. Table 16 shows the predicted maximum 1-hr average CO concentrations, and Table 54 shows the calculated maximum 8-hr average CO concentrations. The ratios of the maximum CO concentrations generated (i.e., without the background concentration) to the maximum CO concentration generated in the full implementation year of alternative 1b also are provided. The percent contributions of each vehicle type, including snowplows (heavy trucks), to the generation of CO are presented in Table 55.

The generated maximum 1-hr average and 8-hr average concentrations of CO for the full implementation scenarios of alternative 1b and 3 are equal. Those of the full implementation scenario of alternative 2 are 2.90 times higher. The generated maximum 1-hr average and 8-hr average CO concentrations are equal for both years 1 and 2 of alternative 1b and year 1 of alternative 3, representing 5.5 times the maximum concentrations of the full implementation scenario of alternative 1b. Both years 1 and 2 of alternative 2 generated the same maximum concentration, which is 3 times the maximum concentrations of the full implementation scenario of alternative 1b. None of the predicted 1-hr average and 8-hr average CO concentrations (with the background concentration) exceeds the 1hr average and 8-hr average CO concentrations exceed the state and NAAQS of 35 ppm and 9 ppm, respectively. Here, wheeled vehicles contribute the most in the generation of CO, when they are included in a given scenario.

Table 53. Maximum 1-hour average CO concentrations at the Flagg Ranch to Colter Bay roadway segment.

Alternative	1-hr Maximum Concentration (w/o bkgd) (ppm)	1-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd))
Alt 1b year 1	1.10	1.75	5.5
Alt 1b year 2	1.10	1.75	5.5
Alt 1b year 3 and beyond	0.20	0.85	1.00
Alt 2 year 1	0.60	1.25	3.00
Alt 2 year 2	0.60	1.25	3.00
Alt 2 year 3 and beyond	0.58	1.23	2.90
Alt 3 year 1	1.10	1.75	5.5
Alt 3 year 2 and beyond	0.20	0.85	1.00

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 54. Maximum 8-hour average CO concentrations at the Flagg Ranch to Colter Bay Junction roadway segment.

Alternative	8-hr Maximum Concentration (w/o bkgd) (ppm)	8-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 2 and Beyond (w/o bkgd)
Alt 1b year 1	0.77	1.23	5.50
Alt 1b year 2	0.77	1.23	5.50
Alt 1b year 3 and beyond	0.14	0.60	1.00
Alt 2 year 1	0.42	0.88	3.00
Alt 2 year 2	0.42	0.88	3.00
Alt 2 year 3 and beyond	0.41	0.86	2.90
Alt 3 year 1	0.77	1.23	5.50
Alt 3 year 2 and beyond	0.14	0.60	1.00

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 55. Contributions to CO concentrations at Flagg Ranch to Colter Bay roadway segment.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	20.5	0.0	21.5	51.7	0.9	0.7	4.8
Alt 1b year 2	20.5	0.0	21.5	51.7	0.9	0.7	4.8
Alt 1b beyond year 3	0.0	97.3	0.0	0.0	2.7	0.0	0.0
Alt 2 year 1	98.4	0.0	0.0	0.0	1.6	0.0	0.0
Alt 2 year 2	98.4	0.0	0.0	0.0	1.6	0.0	0.0
Alt 2 beyond year 3	99.6	0.0	0.0	0.0	0.4	0.0	0.0
Alt 3 year 1	20.5	0.0	21.5	51.7	0.9	0.7	4.8
Alt 3 beyond year 2	99.2	0.0	0.0	0.0	0.8	0.0	0.0

PM_{10} Concentrations. The predicted maximum 1-hr average concentrations of PM_{10} and the calculated maximum 24-hr average concentrations of PM_{10} are presented in Table 56 along

with the ratios of maximum 24-hr average concentrations of PM_{10} for all the scenarios of alternatives 1b and 2 and that the full implementation scenario of alternative 1b. The percent contributions of each vehicle type, including snowplows (heavy trucks), to the generation of PM_{10} are presented in Table 57.

Table 56. Maximum PM_{10} concentrations at the Flagg Ranch to Colter Bay roadway segment.

Alternative	1-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/ bkgd) ($\mu g/m^3$)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	3.00	1.20	6.20	3.00
Alt 1b year 2	3.00	1.20	6.20	3.00
Alt 1b year 3 and beyond	1.00	0.40	5.40	1.00
Alt 2 year 1	2.00	0.80	5.80	2.00
Alt 2 year 2	2.00	0.80	5.80	2.00
Alt 2 year 3 and beyond	5.80	2.32	7.32	5.80
Alt 3 year 1	3.00	1.20	6.20	3.00
Alt 3 year 2 and beyond	<0.01	<0.01	5.00	<0.00

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration.
A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 57. Contributions to PM_{10} concentrations at the Flagg Ranch to Colter Bay roadway segment.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	18.7	0.0	10.5	20.9	27.8	20.2	1.9
Alt 1b year 2	18.7	0.0	10.5	20.9	27.8	20.2	1.9
Alt 1b beyond year 3	0.0	25.2	0.0	0.0	74.8	0.0	0.0
Alt 2 year 1	86.1	0.0	0.0	0.0	13.9	0.0	0.0
Alt 2 year 2	86.1	0.0	0.0	0.0	13.9	0.0	0.0
Alt 2 beyond year 3	96.6	0.0	0.0	0.0	3.43	0.0	0.0

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 3 year 1	18.7	0.0	10.5	20.9	27.8	20.2	1.9
Alt 3 beyond year 2	62.4	0.0	0.0	0.0	37.6	0.0	0.0

The full implementation scenario of alternative 3 performs better than the alternative 1b scenario while that for alternative 2 performs worse. The ratios of the generated 24-hr average maximum PM_{10} concentrations to that of alternative 1b (year 3 and beyond) are 5.80 and <0.01 for alternatives 2 and 3, respectively. None of the predicted 24-hr average PM_{10} concentrations (with the background concentration) exceeds the state or National AAQSs for the 24-hr average concentration of PM_{10}, which is 150 $\mu g/m^3$.

Mammoth to Northeast Entrance Roadway Segment

The Mammoth Hot Springs to Tower Roosevelt road segment is approximately 29 km long. The segment selected for modeling is a 6-km stretch of the road starting approximately 10 km from Mammoth Hot Springs. This road segment is characterized by wheeled vehicle use only. It was also subdivided into four short links. It was assumed that the vehicle use does not change yearly nor by alternative and that the emission factors do not change.

CO Concentrations. Tables 58 to 60 present the modeling results of the Mammoth Hot Springs to Tower Roosevelt road segment for CO and for each alternative. Table 58 shows the predicted maximum 1-hr average CO concentrations, and Table 59 shows the calculated maximum 8-hr average CO concentrations. The ratios of the maximum CO concentrations generated (i.e., without the background concentration) to the maximum CO concentration generated in the full implementation year of alternative 1b also are provided. The percent contributions of each vehicle type, including snowplows (heavy trucks), to the generation of CO are presented in Table 60.

Table 58. Maximum 1-hour average CO concentrations at the Mammoth to Northeast Entrance roadway segment.

Alternative	1-hr Maximum Concentration (w/o bkgd) (ppm)	1-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	0.30	0.95	1.00
Alt 1b year 2	0.30	0.95	1.00

Alternative	1-hr Maximum Concentration (w/o bkgd) (ppm)	1-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 3 and beyond	0.30	0.95	1.00
Alt 2 year 1	0.30	0.95	1.00
Alt 2 year 2	0.30	0.95	1.00
Alt 2 year 3 and beyond	0.30	0.95	1.00
Alt 3 year 1	0.30	0.95	1.00
Alt 3 year 2 and beyond	0.30	0.95	1.00

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 59. Maximum 8-hour average CO concentrations at the Mammoth to Northeast Entrance roadway segment.

Alternative	8-hr Maximum Concentration (w/o bkgd) (ppm)	8-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	0.21	0.67	1.00
Alt 1b year 2	0.21	0.67	1.00
Alt 1b year 3 and beyond	0.21	0.67	1.00
Alt 2 year 1	0.21	0.67	1.00
Alt 2 year 2	0.21	0.67	1.00
Alt 2 year 3 and beyond	0.21	0.67	1.00
Alt 3 year 1	0.21	0.67	1.00
Alt 3 year 2 and beyond	0.21	0.67	1.00

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Because it was assumed that the vehicle use does not change yearly nor by alternative and that the emission factors do not change either, the maximum CO concentrations are the same for each alternative. The generated maximum 1-hr average and 8-hr average CO concentrations are equal to 0.30 ppm and 0.21 ppm respectively. The highest contribution to CO generation is from light trucks.

Table 60. Contributions to CO concentrations at Mammoth to Northeast Entrance roadway segment.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	0.0	0.0	27.9	66.2	1.5	0.6	3.8
Alt 1b year 2	0.0	0.0	27.9	66.2	1.5	0.6	3.8
Alt 1b beyond year 3	0.0	0.0	27.9	66.2	1.5	0.6	3.8
Alt 2 year 1	0.0	0.0	27.9	66.2	1.5	0.6	3.8
Alt 2 year 2	0.0	0.0	27.9	66.2	1.5	0.6	3.8
Alt 2 beyond year 3	0.0	0.0	27.9	66.2	1.5	0.6	3.8
Alt 3 year 1	0.0	0.0	27.9	66.2	1.5	0.6	3.8
Alt 3 beyond year 2	0.0	0.0	27.9	66.2	1.5	0.6	3.8

PM_{10} Concentrations. The predicted maximum 1-hr average concentrations of PM_{10} and the calculated maximum 24-hr average concentrations of PM_{10} are presented in Table 24 along with the ratios of maximum 24-hr average concentrations of PM_{10} for all scenarios of alternatives 2 and 3 and that the full implementation scenario of alternative 1b. The percent contributions of each vehicle type, including snowplows (heavy trucks), to the generation of PM_{10} are presented in Table 62.

Table 61. Maximum PM_{10} concentrations at the Mammoth to Northeast Entrance roadway segment.

Alternative	1-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/ bkgd) ($\mu g/m^3$)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	1.00	0.40	5.40	1.00
Alt 1b year 2	1.00	0.40	5.40	1.00
Alt 1b year 3 and beyond	1.00	0.40	5.40	1.00
Alt 2 year 1	1.00	0.40	5.40	1.00
Alt 2 year 2	1.00	0.40	5.40	1.00

Alternative	1-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/ bkgd) ($\mu g/m^3$)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 2 year 3 and beyond	1.00	0.40	5.40	1.00
Alt 3 year 1	1.00	0.40	5.40	1.00
Alt 3 year 2 and beyond	1.00	0.40	5.40	1.00

A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration.
A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b.

Table 62. Contributions to PM_{10} concentrations at the Mammoth to Northeast Entrance roadway segment.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	0.0	0.0	12.9	25.2	44.9	15.5	1.5
Alt 1b year 2	0.0	0.0	12.9	25.2	44.9	15.5	1.5
Alt 1b beyond year 3	0.0	0.0	12.9	25.2	44.9	15.5	1.5
Alt 2 year 1	0.0	0.0	12.9	25.2	44.9	15.5	1.5
Alt 2 year 2	0.0	0.0	12.9	25.2	44.9	15.5	1.5
Alt 2 beyond year 3	0.0	0.0	12.9	25.2	44.9	15.5	1.5
Alt 3 year 1	0.0	0.0	12.9	25.2	44.9	15.5	1.5
Alt 3 beyond year 2	0.0	0.0	12.9	25.2	44.9	15.5	1.5

Because it was assumed that the vehicle use does not change yearly nor by alternative and that the emission factors do not change either, the maximum PM_{10} concentrations are the same for each alternative. The generated maximum 24-hr average PM_{10} concentration is equal to 0.40 $\mu g/m^3$. The highest contribution to PM_{10} generation is from heavy trucks.

Staging Areas

The Old Faithful and Flagg Ranch staging areas also were modeled in this study. Old Faithful contains three main parking areas designed primarily for visitors, while Flagg Ranch contains two main parking areas designed for visitors, guides, and outfitters. Traffic in both

staging areas is in idling or slow-moving mode for long periods of time. Therefore, they were modeled as area sources using the EPA ISCST3 model. ISCST3 is a refined dispersion model based on the steady-state Gaussian plume equation designed to estimate concentration or deposition levels for each source-receptor combination. It requires source characteristics, source strength, hourly meteorological data, receptor locations, and terrain data as critical input data. In each of the two staging areas, a single area encompassing the major parking lots were drawn and used as modeling areas. The composite CO and PM_{10} peak hourly idle emission factors were calculated based on the emission factors presented in Tables 38 to 39. A gridded receptor system was located around the areas using a 100-meter spacing up to a distance of 1,000 m.

Old Faithful

CO Concentrations. Tables 63 to 65 present the modeling results of the Old Faithful staging area for CO and for each alternative. Table 63 shows the predicted maximum 1-hr average CO concentrations, and Table 64 shows the calculated maximum 8-hr average CO concentrations. The ratios of the maximum CO concentrations generated (i.e., without the background concentration) to the maximum CO concentration generated in the full implementation year of alternative 1b are also are provided. The percent contributions of each vehicle type, including groomers (heavy trucks), to the generation of CO are presented in Table 55.

Table 63. Maximum 1-hour average CO concentrations at Old Faithful.

Alternative	1-hr Maximum Concentration (w/o bkgd) (ppm)	1-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	1.29	1.94	1.16
Alt 1b year 2	1.27	1.92	1.14
Alt 1b year 3 and beyond	1.11	1.76	1.00
Alt 2 year 1	0.84	1.49	0.76
Alt 2 year 2	0.83	1.49	0.75
Alt 2 year 3 and beyond	0.66	1.31	0.59
Alt 3 year 1	1.29	1.94	1.16
Alt 3 year 2 and beyond	0.13	0.78	0.12

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 64. Maximum 8-hour average CO concentrations at Old Faithful.

Alternative	8-hr Maximum Concentration (w/o bkgd) (ppm)	8-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	0.22	0.67	1.22
Alt 1b year 2	0.21	0.67	1.14
Alt 1b year 3 and beyond	0.18	0.64	1.00
Alt 2 year 1	0.14	0.60	0.76
Alt 2 year 2	0.14	0.60	0.75
Alt 2 year 3 and beyond	0.11	0.57	0.59
Alt 3 year 1	0.22	0.67	1.22
Alt 3 year 2 and beyond	0.02	0.48	0.12

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 65. Contributions to CO concentrations at Old Faithful.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	97.4	1.9	0.0	0.0	0.7	0.0	0.0
Alt 1b year 2	95.8	3.1	0.0	0.0	1.1	0.0	0.0
Alt 1b beyond year 3	0.0	96.7	0.0	0.0	3.3	0.0	0.0
Alt 2 year 1	95.2	3.6	0.0	0.0	1.2	0.0	0.0
Alt 2 year 2	94.2	4.4	0.0	0.0	1.5	0.0	0.0
Alt 2 beyond year 3	94.0	4.5	0.0	0.0	1.5	0.0	0.0
Alt 3 year 1	97.4	1.9	0.0	0.0	0.7	0.0	0.0
Alt 3 beyond year 2	53.1	41.5	0.0	0.0	5.4	0.0	0.0

All the scenarios of alternative 2 and year 3 of alternative 3 perform better than the full implementation scenario of alternative 1b. The ratio of the generated 1-hr average and 8-hr average maximum CO concentrations to those of the full implementation of alternative 1b varies from 0.59 to 0.76 for alternative 2 and is equal to 0.12 for alternative 3. year 1 of alternatives 1b and 3 represent the existing conditions that show concentrations 1.22 times higher than those of the full implementation scenario of alternative 1b (year 3 and beyond).

None of the predicted 1-hr average and 8-hr average CO concentrations (with the background concentration) exceeds the 1-hr average and 8-hr average CO concentration the Wyoming and National AAQS of 35 ppm and 9 ppm, respectively.

PM_{10} Concentrations. The predicted maximum 24-hr average concentrations of PM_{10} are presented in Table 66 along with the ratios of maximum 24-hr average concentrations of PM_{10} for all scenarios of alternatives 2 and 3 and the full implementation scenario of alternative 1b. The percent contributions of each vehicle type, including groomers (heavy trucks), to the generation of PM_{10} are presented in Table 67.

Table 66. Maximum PM_{10} concentrations at Old Faithful.

Alternative	24-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/ bkgd) ($\mu g/m^3$)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	0.63	5.63	10.50
Alt 1b year 2	0.62	5.62	10.33
Alt 1b year 3 and beyond	0.06	5.06	1.00
Alt 2 year 1	0.41	5.41	6.83
Alt 2 year 2	0.41	5.41	6.83
Alt 2 year 3 and beyond	0.32	5.32	5.33
Alt 3 year 1	0.63	5.63	10.5
Alt 3 year 2 and beyond	0.03	5.03	0.50

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alternative 1b (i.e., year 3 and beyond).

Table 67. Contributions to PM_{10} concentrations at Old Faithful.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	97.8	0.0	0.0	0.0	2.2	0.0	0.0
Alt 1b year 2	96.3	0.0	0.0	0.0	3.6	0.0	0.0
Alt 1b beyond year 3	0.0	0.2	0.0	0.0	99.8	0.0	0.0
Alt 2 year 1	95.9	0.0	0.0	0.0	4.1	0.0	0.0
Alt 2 year 2	94.9	0.0	0.0	0.0	5.1	0.0	0.0
Alt 2	94.8	0.0	0.0	0.0	5.2	0.0	0.0

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
beyond year 3							
Alt 3 year 1	97.8	0.0	0.0	0.0	2.2	0.0	0.0
Alt 3 beyond year 2	52.9	0.0	0.0	0.0	47.1	0.0	0.0

Similar to CO, all the scenarios of alternative 2 and year 3 of alternative 3 perform better than the full implementation scenario of alternative 1b. The ratio of the generated 24-hr average PM_{10} concentrations to those of the full implementation of alternative 1b varies from 5.33 to 6.83 for alternative 2 and is equal to 0.50 for alternative 3. year 1 of alternatives 2 and 3 represent the existing conditions that show concentrations 10.50 times higher than those of the full implementation scenario of alternative 1b (year 3 and beyond). Moreover, none of the predicted 24-hr average PM_{10} concentrations (with the background concentration) exceeds the NAAQS for the 24-hr average concentration of PM_{10}, which is 150 $\mu g/m^3$. Furthermore, the contributions of snowmobiles are highest in the snowmobile-containing alternatives

Flagg Ranch

CO Concentrations. Tables 68-70 present the modeling results of the Flagg Ranch staging area for CO and for each alternative. Table 31 shows the predicted maximum 1-hr average CO concentrations, and Table 69 shows the calculated maximum 8-hr average CO concentrations. The ratios of the maximum CO concentrations generated (i.e., without the background concentration) to the maximum CO concentration generated in the full implementation year of alternative 1b also are provided. The percent contributions of each vehicle type, including snowplows (heavy trucks), to the generation of CO are presented in Table 70.

Table 68. Maximum 1-hour average CO concentrations at Flagg Ranch.

Alternative	1-hr Maximum Concentration (w/o bkgd) (ppm)	1-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	1.66	2.31	1.23
Alt 1b year 2	1.66	2.31	1.23

Alternative	1-hr Maximum Concentration (w/o bkgd) (ppm)	1-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 3 and beyond	1.35	2.00	1.00
Alt 2 year 1	1.04	1.70	0.77
Alt 2 year 2	1.04	1.70	0.77
Alt 2 year 3 and beyond	0.9	1.55	0.67
Alt 3 year 1	1.66	2.31	1.23
Alt 3 year 2 and beyond	0.12	0.77	0.09

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alt. 1b

Table 69. Maximum 8-hour average CO concentrations at Flagg Ranch.

Alternative	8-hr Maximum Concentration (w/o bkgd) (ppm)	8-hr Maximum Concentration (w/ bkgd) (ppm)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	0.28	0.73	1.27
Alt 1b year 2	0.28	0.73	1.27
Alt 1b year 3 and beyond	0.22	0.68	1.00
Alt 2 year 1	0.17	0.63	0.77
Alt 2 year 2	0.17	0.63	0.77
Alt 2 year 3 and beyond	0.15	0.61	0.67
Alt 3 year 1	0.28	0.73	1.27
Alt 3 year 2 and beyond	0.02	0.48	0.09

Table 70. Contributions to CO concentrations at Flagg Ranch.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	71.9	1.3	7.9	15.6	1.5	0.3	1.4
Alt 1b year 2	71.9	1.3	7.9	15.6	1.5	0.3	1.4
Alt 1b beyond year 3	0.0	92.6	0.0	0.0	7.4	0.0	0.0

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 2 year 1	89.6	4.9	0.0	0.0	5.6	0.0	0.0
Alt 2 year 2	89.6	4.9	0.0	0.0	5.6	0.0	0.0
Alt 2 beyond year 3	95.5	2.1	0.0	0.0	2.4	0.0	0.0
Alt 3 year 1	71.9	1.3	7.9	15.6	1.5	0.3	1.4
Alt 3 beyond year 2	82.5	8.1	0.0	0.0	9.3	0.0	0.0

The Flagg Ranch staging area shows the same trend as the Old Faithful staging area. All the scenarios of alternative 2 and year 3 of alternative 3 perform better than the full implementation scenario of Alternative 1b. The ratio of the generated 1-hr average and 8-hr average maximum CO concentrations to those of the full implementation of alternative 1b varies from 0.67 to 0.77 for alternative 2 and is equal to 0.09 for alternative 2. Year 1 of alternatives 1b and 3 represent the existing conditions that show concentrations 1.27 times higher than those of the full implementation scenario of alternative 1b (year 3 and beyond). None of the predicted 1-hr average and 8-hr average CO concentrations (with the background concentration) exceeds the 1-hr average and 8-hr average CO concentration Wyoming and National AAQSs of 35 ppm and 9 ppm, respectively.

PM_{10} Concentrations. The predicted maximum 24-hr average concentrations of PM_{10} are presented in Table 71 along with the ratios of maximum 24-hr average concentrations of PM_{10} for all scenarios of alternatives 2 and 3 and that the full implementation scenario of alternative 1b. The percent contributions of each vehicle type, including snowplows (heavy trucks), to the generation of PM_{10} are presented in Table 72.

Table 71. Maximum PM_{10} concentrations at Flagg Ranch.

Alternative	24-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/ bkgd) ($\mu g/m^3$)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 1b year 1	0.63	5.63	3.70
Alt 1b year 2	0.63	5.63	3.70
Alt 1b year 3 and beyond	0.17	5.17	1.00
Alt 2 year 1	0.56	5.56	3.29
Alt 2 year 2	0.56	5.56	3.29

Alternative	24-hr Maximum Concentration (w/o bkgd) ($\mu g/m^3$)	24-hr Maximum Concentration (w/ bkgd) ($\mu g/m^3$)	Ratio Relative to Alt 1b Year 3 and Beyond (w/o bkgd)
Alt 2 year 3 and beyond	0.46	5.46	2.71
Alt 3 year 1	0.63	5.63	3.70
Alt 3 year 2 and beyond	0.04	5.04	0.24

Notes: A ratio equal to one (1) means equal concentrations. A ratio less than 1 means a decrease in concentration. A ratio greater than 1 means an increase in concentration relative to the full implementation of alt. 1b.

Table 72. Contributions to PM_{10} concentrations at Flagg Ranch.

Alternative	Contribution (percent)						
	Snowmobile	Snowcoach	Automobile	Light Truck	Heavy Truck	Tour Bus	Shuttle Van
Alt 1b year 1	92.2	0.0	0.0	0.0	6.6	1.2	0.0
Alt 1b year 2	92.2	0.0	0.0	0.0	6.6	1.2	0.0
Alt 1b beyond year 3	0.0	0.1	0.0	0.0	99.9	0.0	0.0
Alt 2 year 1	82.4	0.0	0.0	0.0	17.6	0.0	0.0
Alt 2 year 2	82.4	0.0	0.0	0.0	17.6	0.0	0.0
Alt 2 beyond year 3	92.1	0.0	0.0	0.0	7.9	0.0	0.0
Alt 3 year 1	92.2	0.0	0.0	0.0	6.6	1.2	0.0
Alt 3 beyond year 2	50.2	0.0	0.0	0.0	49.8	0.0	0.0

Except for the full implementation scenario of alternative 3, the maximum 24-hr average PM_{10} concentrations for all the other scenarios are higher than the maximum 24-hr average PM_{10} concentration of the full implementation scenario of alternative 1b. The contributions of snowmobiles are highest in the snowmobile-containing alternatives. None of the predicted 24-hr average PM_{10} concentrations (with the background concentration) exceeds the 24-1hr average concentration of the Wyoming or NAAQS of 150 $\mu g/m^3$.

Total Mobile Emissions

In addition to the air quality dispersion modeling analysis, the total winter season mobile emissions of CO, PM_{10}, NO_X, and HCs inside the park units were estimated. The estimations were based on the winter use scenarios presented in Appendix A of the air quality analysis report (EA 2001) and the traveling emission factors presented in Tables 34 to 37. The following formulation was used:

$E = EF \times D \times N$ where E = emission rate in grams per hour (g/day)
EF = emission factor in grams per mile (g/vehicle-mile)
D = round trip distance in miles, and
N = number of vehicles (vehicle/day).

The winter year is represented by the two months of January and February because the winter use scenarios estimate the average daily vehicle use for these two months. Table 73 presents the total mobile emissions per alternative. The breakdown of emissions per alternative, location, and vehicle type is presented in Appendix C of the air quality analysis report (EA 2001).

Table 73. Winter use total mobile emissions inside the parks[2].

Alternative	Year	CO (tpy)	PM_{10} (tpy)	NO_X (tpy)	HCs (tpy)
Alt 1a year 1	2002-2003[A]	1,538	11	19	476
Alt 1a year 2 and beyond	2003-2004[A]	479	1	19	63
Alt 1b year 1	2002-2003[A]	1,763	13	20	560
Alt 1b year 2	2003-2004[A]	1,538	11	19	476
Alt 1b year 3 and beyond	2004-2005[A]	479	1	19	63
Alt 2 year 1	2002-2003[B]	2,061	16	36	685
Alt 2 year 2	2003-2004[B]	2,002	16	35	663
Alt 2 year 3 and beyond	2004-2005[B]	1,411	10	39	428
Alt 3 year 1	2002-2003[A]	1,763	13	20	560
Alt 3 year 2 and beyond	2003-2004[A]	694	1	84	80

Note: tpy = tons per year

[A] the winter season would be 110 days in these alternatives

[B] the winter season would be 90 days in this alternative

CO emissions varied from 479 tpy to 2,061 tpy per alternative, PM_{10} emissions from 1.0 tpy to 16 tpy, NO_X emissions from 19.0 tpy to 84 tpy, and HC emissions varied from 63 tpy to 685 tpy per alternative. The lowest CO, PM_{10}, NO_X, and HC emissions occurred in alternative 1b, year 3 and beyond scenario. For the full implementation and beyond years, the highest CO, PM_{10}, and HC emissions occurred in the alternative 2 year 3 and beyond scenario, and the highest NO_X emissions occurred in the alternative 3, year 2 and beyond scenario.

Definition of Impacts

The discussion of impacts of alternatives on vehicle emission exposure focuses on the exposure of employees, visitors, and snowmobile operators and riders to CO and PM_{10} worst-case air pollutant levels predicted by the air dispersion modeling. The intensity of an impact

is categorized as negligible, minor, moderate, or major relative to the existing condition. For this analysis, the definition and intensity of the impact categories are summarized below. All impacts on air quality and public health are defined as short term (see introduction to *Assumptions and Methods for Evaluating Impact*s).

Table 74. Definition and intensity of impacts to air quality and public health.

Impact Category	Definition
Negligible	The impact on public or employee health is not measurable or perceptible. There is no noticeable change in visibility at any time or place.
Minor	The impact is measurable or perceptible and is localized within a relatively small area. However, the overall exposure would not be affected. There may be noticeable but infrequent and short duration changes in visibility near staging areas.
Moderate	The impact is sufficient to cause a change in exposure, but remains localized. The change is measurable and perceptible but could be reversed. There may be noticeable, frequent and regular changes in visibility near staging areas and heavily traveled routes.
Major	The impact is substantial and highly noticeable. There may be noticeable, frequent, long duration and regular changes in visibility near staging areas and heavily traveled routes. Class one airsheds, or areas within them, are degraded.

Conclusions

The relative impacts of the SEIS proposed winter use alternatives on ambient air quality were assessed by means of atmospheric dispersion modeling of the GYA. The West Yellowstone Entrance, the Old Faithful and Flagg Ranch staging areas, and three road segments (West Entrance-Madison Junction, Flagg Ranch-Colter Bay, and Mammoth-Northeast Entrance) were studied. The total winter mobile emissions also were estimated by alternative.

CO and PM_{10} maximum concentrations were found to be the highest at the West Entrance compared to the staging areas and road segments. The predicted 1-hr average maximum CO concentration exceeded the Montana National Ambient Air Quality Standard (NAAQS) for the existing conditions (year 1 of Alternatives 2 and 4) at the West Yellowstone Entrance. The predicted 8-hr average CO concentrations of the existing conditions (year 1 of alternatives 1b and 3), year 2 of alternative 1b, and year 1 of alternative 2 exceeded the Montana and NAAQS at the West Yellowstone Entrance. When snowmobiles were present in the vehicle fleet, their contribution to CO and PM_{10} concentrations were the highest. Most of the predicted maximum CO and PM_{10} concentrations for alternative 2 were higher than

[2] These emission estimates include only those that result from "travelling" through the parks. Total emissions may be underestimated for all alternatives because "idle" emissions are not included.

those of the full implementation of alternative 1b, with the exception of those generated at both staging areas. The full implementation scenario of alternative 3 (year 2 and beyond) performs worst at the West Entrance and along the West Entrance to Madison Junction roadway and better at the staging areas than the full implementation scenario of alternative 1b.

CO emissions varied from 479 tpy to 2,002 tpy per alternative; PM_{10} emissions from 1 tpy; to 16 tpy, NO_X emissions from 19 tpy to 84 tpy; and HC emissions varied from 63 tpy to 685 tpy per alternative. The lowest CO, PM_{10}, NO_X, and HC emissions occurred in the alternative 1b, year 3 and beyond scenario. For the full implementation and beyond years, the highest CO, PM_{10} , and HC emissions occurred in the alternative 2, year 3 and beyond scenario, and the highest NO_X emissions occurred in the alternative 3, year 2 and beyond scenario.

Relative to the existing condition, alternatives 1a and 1b would have major beneficial impacts on air quality. Relative to a hypothetical baseline condition in which there are no air quality impacts, these alternatives would have a negligible impact on most of the park, minor adverse impacts along travel corridors, and minor to moderate adverse impacts at staging areas.

Relative to the existing condition, alternative 2 would have moderate beneficial impacts on air quality. Relative to a hypothetical baseline condition in which there are no air quality impacts, this alternative would have a negligible impact on most of the park, minor adverse impacts along travel corridors, and moderate to major adverse impacts at staging areas.

Relative to the existing condition, alternative 3 would have moderate beneficial impacts on air quality. Relative to a hypothetical baseline condition in which there are no air quality impacts, this alternative would have a negligible impact on most of the park, minor adverse impacts along travel corridors, and moderate adverse impacts at staging areas.

THE EFFECTS OF IMPLEMENTING THE ALTERNATIVES ON WILDLIFE

Methods and Assumptions for SEIS

Analyses of impacts to wildlife are limited to alternative features that pertain to oversnow motorized access in the parks and groomed roads and trails for motorized use. The analysis is further limited to those wildlife species for which new information and analysis may alter the assessment of impacts as disclosed in the FEIS, and for which impacts may vary by alternative (see *Impact Topics Addressed* in Chapter III). Based on the proposed actions,

these species include bison and elk. The analysis of impacts to other species contained in the *Environmental Consequences* chapter of the FEIS remains valid; see pages 237-262 of that document.

National Park Service regulations and policies for management of wildlife underlie the analysis determinations presented in the consequence discussions. A summary of this direction (including legislation and executive orders) is presented in Appendix C of the FEIS.

The following sources of information were used to assess the level of impact on wildlife:

1) Scientific literature on species' life histories, distributions, habitat selection, and responses to human activities.
2) Site-specific information on wildlife species in the parks, including complete and on-going studies (when available), and the professional judgment of park biologists familiar with the management concerns related to individual species. Park-specific information and scientific literature documented in the FEIS on pages 143-158 and 237-262 is hereby incorporated by reference. Alternative 1a in the SEIS contains a review of pertinent, new information available since the publication of the FEIS; subsequent alternative analyses compare and contrast effects relative to alternative 1a.
3) A risk assessment, categorized by road segment, depicts the potential risk of impacts to bison and elk from snowmobiles and snowcoaches.

Effects are characterized according to their intensity and scale of impact on wildlife individuals and populations[3] (Table 75). Effects that remain essentially unchanged from those disclosed in the FEIS are incorporated by reference. Variations in alternatives that mitigate the impacts of these actions are included and reflected in the statements of effects. See *Chapter III Wildlife*, for a list of definitions used when describing the effects of the alternative actions on wildlife.

Table 75. Definition of impacts to wildlife.

Impact Category	Definition
No Effect	An action that does not affect a species.
No Known Effect	An action that may affect a species elsewhere but for which there are no demonstrated impacts known to occur in the parks.
Adverse Negligible Effect	An action that may affect a population or individuals of a species, but the effect will be so small that it will not be of any measurable or perceptible consequence to the population. Risks are considered low.
Adverse Minor	An action that may affect a population or individuals of a species, but the

[3] Definitions are loosely based on ESA impact criteria that differentiate between levels of effects based on their degree of measurability or detectability.

Impact Category	Definition
Effect	effect will be small; if it is measurable, it will be a small and localized consequence to the population. Risks are considered low to medium.
Adverse Moderate Effect	An action that will affect a population or individuals of a species; the effect may be measurable and may have a sufficient consequence to the population but is more localized. Risks are considered medium.
Adverse Major Effect	An action that will noticeably affect a population or individuals of a species; the effect will be measurable and will have a substantial and possible permanent consequence to the population. Risks are considered high.

Effects Common to All Alternatives

Effects of oversnow motorized sound

Animals may exhibit physiological and behavioral responses to human-caused noise. For a literature review of the effects of noise on wildlife see page 222 in the FEIS. An analysis of these effects is implicit in the assessment of motorized use for each alternative. It can be inferred that as the level, location, and type of motorized use changes, so will the associated effects of motorized sound. An analysis of how the natural soundscape is impacted by alternative is included in this chapter.

Effects of oversnow motorized use

Alternatives 1a and 1b provide for the use of mass-transit snowcoaches; alternatives 2 and 3, while retaining the use of snowcoaches, provide for the use of snowmobiles. Effects associated with oversnow motorized use include disturbance to wildlife from the sight, sound and smell of the machines, and the presence of groomed roads and trails to facilitate their use. Conclusions related to the effects of oversnow motorized use did not change from those presented in the FEIS for alternatives that feature comparable numbers of oversnow motorized vehicles.

General Effects

Winter recreation activities take place during the season when animals are stressed by climate and food shortages. Disturbance or harassment of wildlife during this sensitive time can have a negative effect on individual animals and, in some cases, populations as a whole (Moen et al. 1982). Human activities may provoke the following responses: elevation of heart rate and metabolism; elevated stress hormones (i.e., glucocorticoids); flight;

displacement from habitats; reduced reproduction; increased susceptibility to predation; and diminished health as a result of increased energy costs (Creel et al. 2001; Hardy et al. 2001; Moen et al. 1982; Geist 1978; Cassier et al. 1992; Picton 1999; Aune 1981). Because many of these responses are difficult to detect, animals that may appear unaffected by human activities may nonetheless be suffering from adverse effects. In YNP's Madison, Firehole, and Gibbon River valleys, Aune (1981) reported that wildlife developed crepuscular patterns in response to winter recreation activity, were displaced from trailsides, and that their movements were inhibited by traffic and snow berms created by plowing and grooming operations. Conversely, animals may be able to habituate over time to human activities, providing that such activities are conducted in a predicable and regular manner. Habituation has been defined as a waning of behavioral response to a repeated stimuli (Whittaker and Knight 1998). Habituation may occur when flight or displacement are not possible (e.g., in critical or limited winter range, during severe winters when the snowpack is deep, or when the weakened physical state of the animal precludes it). Although habituated ungulates may fail to exhibit overt behavioral responses, research has shown that physiological responses, including an increase in heart rates, may occur and can result in high energy expenditures (Canfield et al. 1999). Increases in energy expenditures during the stressful winter period are considered deleterious to the overall physical condition of the animal.

The Effects of Implementing Alternative 1a— No Action on Wildlife

Ungulates (Elk and Bison)

Effects of oversnow motorized use. The use of motorized oversnow vehicles can cause injury and death for wildlife, habitat displacement, behavioral changes and physiological stress responses. This alternative would restrict public oversnow access to snowcoaches. In YNP, all existing groomed routes would be available for snowcoach use, and in GTNP, snowcoaches would be allowed on the groomed surface of the road from Colter Bay to Flagg Ranch, north to YNP, and on the Grassy Lake Road. The winter use season would run from approximately late November to mid-March, and all groomed roads would be closed to public entry by March 15 (latest closing date).

Because the annual number of road killed ungulates caused by oversnow vehicles was estimated at less than 1% of each species' total population (Gunther et al. 1998) impacts related to road kills are considered none to negligible and short term (see pages 239-241 in the FEIS for a review of collision impacts). Despite the small number of road killed ungulates relative to the size of their populations, NPS is concerned about impacts to

individuals and seeks to minimize collisions caused by motorized vehicles of all kinds. Because snowmobiles are responsible for all oversnow-wildlife collisions to date (Gunther, pers. comm.), eliminating their use would decrease the potential for collisions to nearly zero. Conversely, alternatives that increase oversnow traffic in wildlife winter range (where the majority of collisions occur) would likely increase the frequency of road killed wildlife (Gunther et al. 1998).

Human activities that result in displacement of animals from parts of their home range may be considered a form of habitat fragmentation. In particular, increased access into elk winter range as provided by plowed and groomed roads may reduce the overall scale and effectiveness of elk habitat, and lead to increased harassment and energetic stress (Picton 1999). In YNP, Hardy et al. (2001) documented that elk may have been displaced from suitable roadside habitat along the busiest winter road in the park (West Yellowstone to Old Faithful) in part due to high volumes of oversnow motorized vehicles. Therefore it may be concluded that the greater the number of oversnow vehicles in wildlife winter range, the higher the risk of harassment and displacement. Consequently, because the alternatives vary in the number of allowable oversnow motorized vehicles on various road segments, risks to wildlife would be expected to vary by road segment as well.

To assess this level of risk among the alternatives, road segments in YNP were categorized as being of "High", "Medium," and "Low" risk for wildlife conflicts based on the YNP employee survey described in *Chapter III Wildlife*. Identified conflicts were associated with oversnow motorized use and included animals being herded down roadways, animals being prevented from crossing roads, and animals fleeing from oversnow motorized activities. For each road segment, risk was predicated on the perceived number of wildlife conflicts reported along each road segment and the projected average daily number of oversnow vehicles.

"High" risk segments were those that were reported by the majority of respondents to have daily occurrences of conflicts between wildlife and oversnow motorized vehicles. "Medium" risk segments were those that had weekly conflicts, and "Low" risk segments were those that had monthly conflicts. Because the survey results represent current condition, alternatives presented in the SEIS that modify use numbers alter the assessment of risks relative to the current condition (Table 76). For each alternative, the number of estimated oversnow vehicles on each road segment was compared to the number and risk rating under the current condition. Where numbers approximated the current condition, the

associated risk did not change. Conversely, where numbers were lower or higher than the current condition, the potential risk associated with that segment changed accordingly.

Alternative 1a prohibits the use of snowmobiles. Therefore the overall number of oversnow vehicles in YNP would be greatly reduced. Consequently, along road segments where risk was rated as "High" or "Medium" under the current condition, risk would decline. This was true of the segments from the West Entrance to Old Faithful, Canyon Village to Fishing Bridge, and Fishing Bridge to the East Entrance. The remaining segments were all currently rated as "Low"; further reduction of numbers on these segments would not be expected to change the potential risk. To summarize, the risk assessment for 1a indicates that for road segments that currently have a high risk for wildlife-oversnow motorized use conflicts, risks greatly decrease due to the elimination of snowmobiles specifically, and the overall reduction in traffic volumes generally.

In YNP, both Hardy et al. (2001) and Aune (1981) concluded that bison and elk habituated to snowmobiles to some degree as exposure to traffic increased throughout the winter recreation season. However both of these studies and Bjornlie (2000) reported that when behavioral responses were elicited, they most often resulted in the bison fleeing, with snowmobiles frequently herding them down the packed trails. To provide an index of physiological stress, Hardy et al. (2001) measured fecal glucocorticoid (FGC) levels and found them to be higher in bison and elk during wheeled vehicle travel as opposed to snowmobiles or snowcoaches. FGC levels in elk increased as traffic entering the West Yellowstone gate exceeded 7,500 cumulative vehicles subsequent to the opening of the spring season. When comparing elk responses to various levels of oversnow traffic, FGC levels were found to be greater in elk that occurred near the busiest oversnow road in the park (West Yellowstone to Old Faithful) than other less frequented roads. While acknowledging that elk FGC levels could potentially increase depending upon winter visitation levels and management scenarios, and despite documented effects, Hardy et al. (2001) concluded that overall, elk and bison were co-existing with winter recreation without declines in population levels.

Table 76. Relative risks associated with each road segment as based on a YNP employee survey related to wildlife and oversnow motorized use conflicts. "High" indicates daily occurrences of conflicts between wildlife and oversnow motorized traffic; "Medium" indicates weekly conflicts; and "Low" indicates monthly conflicts.

Road Segments	Current Condition			Alternatives 1a and 1b			Alternative 2			Alternative 3		
	Risk	Coach	'Bile	Risk	Coach	'Bile	Risk	Coach	'Bile	Risk	Coach	'Bile
West Entrance to Madison	High	9	554	Low	88	0	High	10	533	Medium	33	352
Madison to Old Faithful	High	10	489	Low	80	0	High	10	802	High	33	574
Old Faithful to West Thumb	High	4	209	Low	34	0	High	4	337	High	5	241
Fishing Bridge to East Entrance	High	0	36	Low	5	0	High	0	222	High	0	111
Canyon Village to Fishing Bridge	Medium	3	148	Low	24	0	High	3	243	Medium	3	174
Madison to Norris	Low	5	247	Low	40	0	Medium	5	406	Low	12	290
Mammoth to Norris	Low	3	31	Low	8	0	Medium	3	111	Medium	3	111
West Thumb to Flagg	Low	4	176	Low	29	0	High	4	533	Medium	5	426
Fishing Bridge to West Thumb	Low	3	125	Low	20	0	Medium	3	205	Low	3	147
Norris to Canyon	Low	4	185	Low	30	0	Medium	4	300	Low	4	215

In contrast, Creel et al. (2001) found that FGC levels in YNP elk were higher in response to snowmobiles as opposed to wheeled vehicles, and that day-to-day variation in FGC levels paralleled variation in the number of oversnow vehicles (of which snowcoaches constituted 2% of the total number). Although the two studies are not directly comparable due to differences in methodology, the Creel et al. study demonstrates that oversnow traffic may indeed be affecting elk in YNP, depending perhaps upon other variables (e.g., the year the data were collected there was an unusually heavy snowpack). Nonetheless, Creel et al. found no evidence that current snowmobile levels were affecting elk populations as a whole.

This alternative reduces the potential effects on ungulates by eliminating snowmobile use. A minor risk of collision and short term stress-induced movement would continue with the use of snowcoaches. However, compared to current levels of snowmobile use, traffic levels would be reduced by a factor of eight or more and NPS policy would require that snowcoach drivers be trained to recognize potential wildlife conflicts and instructed to stop only in areas where wildlife would be unaffected. In all parks, collisions would further be mitigated by the prohibition on oversnow motorized use from 9 P.M. to 8 A.M.

The effects analysis in the FEIS under alternative G remains valid: given an analysis of the available data, the level of effects related to oversnow motorized use on ungulates range from none to negligible (collisions) to minor and short term (harassment and displacement).

Effects of groomed roads and trails for motorized use. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative 1a, YNP would groom a total of 184 miles for motorized use, and GTNP and the Parkway would groom about 23 miles for motorized use. Adaptive management would be employed in all alternatives to evaluate the effects of winter recreation on wildlife and to formulate management alternatives if necessary. Preliminary standards for adaptive management under alternative 1a are based on park policies, regulations and Executive Orders that state a "no disturbance" or "no adverse effects" criteria when assessing the impacts of park actions on wildlife.

The primary concern under this impact topic is the effect of groomed routes on bison (and to a lesser degree, elk) in YNP. Specifically, two issues remain speculative: 1) does bison use of groomed routes affect their population dynamics and distribution, and 2) is the energy saved by walking on these packed surfaces greater than that expended during responses to

traffic encountered along these routes. Pages 238-239 in the FEIS contain a review of these issues. Since the publication of the FEIS, ongoing monitoring of the bison population continues to support the contention that bison use of groomed routes is relatively minor compared to their use of established game trails and other off-road travel corridors (Reinertson et al. 2001). The degree to which this use influences the bison population is disputable and under study.

The effects analysis in the FEIS under alternative G remains valid. Impacts related to the existence of groomed roads and trails remain largely unknown at this time. The parks are committed to ongoing monitoring of bison and elk to obtain addition information regarding this important topic.

Conclusion

Conclusions described in the FEIS on page 422 remain valid. The potential for adverse impacts to elk and bison from oversnow motorized use under alternative 1a range from none to minor, and all would be considered short term. Specifically, there would be an expected reduction or elimination of road killed large mammals due to the elimination of snowmobiles in the parks. In addition, the replacement of individual snowmobiles with mass transit snowcoaches would serve to decrease potential risks associated with disturbance along particular road segments by greatly reducing traffic volume. Adaptive management would be employed to make adjustments in management if and when impacts to wildlife are determined. In summary, although impacts from winter recreation on individual animals would continue to occur and are adverse, most likely they would not result in long term effects to the bison and elk population in the parks.

Summary of Effects on Elk and Bison

Effects of motorized oversnow use of groomed and ungroomed roads and trails on:

- mortality caused by collisions — adverse, none to negligible and short term;
- harassment and displacement from preferred habitats — adverse, negligible to minor and short term;
- FGC levels — unknown to what extent stress may be affecting populations in the long term.
- effects of groomed roads and trails on animal movements — unknown if and to what extent beneficial effects outweigh negative effects.

Effects of Implementing Alternative 1b on Wildlife

All effects described under alternative 1a remain unchanged. The principle difference between alternatives 1a and 1b is that under alternative 1b, implementation would be delayed one year. Consequently, snowmobiles would be phased out by 50% beginning 2003-2004, and beginning 2004-2005 access would be limited to snowcoaches only.

The Effects of Implementing Alternative 2 on Wildlife

Ungulates (Elk and Bison)

Effects of motorized oversnow use. The use of motorized oversnow vehicles can cause injury and death for wildlife, habitat displacement, behavioral changes and physiological stress responses. Under alternative 2, these effects are associated with about 184 miles of groomed road surface in YNP and about 35 miles of groomed surface for motorized use in GTNP and the Parkway, including Grassy Lake Road, and the CDST. In YNP, the speed limit would be lowered to 35 mph from the West Entrance to Madison and Old Faithful and oversnow travel would be prohibited from 8 P.M. to 7:30 A.M (8:30 A.M. through the West Entrance). Snowcoaches would be permitted in the park beginning mid-November; access to snowmobiles would occur from mid-December to mid-March dependent upon adequate snow conditions (see *Actions for Yellowstone National Park*, Chapter II. in this document).

Because the use of snowmobiles would be allowed in the parks under alternative 2, overall associated effects would increase relative to alternative 1a. To assess the potential level of risk along each road segment by alternative, road segments in YNP were categorized as being of "High", "Medium," and "Low" risk for wildlife conflicts based on the YNP employee survey described in Chapter III and described above under the wildlife analysis in alternative 1a. Identified conflicts were associated with oversnow motorized use and included animals being herded down roadways, animals being prevented from crossing roads, and animals fleeing from oversnow motorized activities. For each road segment, risk was predicated on the perceived number of wildlife conflicts reported along each road segment and the projected average daily number of oversnow vehicles.

Relative to the current condition and alternatives 1a and 1b, risks to wildlife from oversnow motorized use in alternative 2 increase along every road segment due to the increase in traffic volumes (Table 20). Six of the ten segments were rated as "High" indicating that conflicts among wildlife and oversnow vehicles would be expected to occur daily. The remaining four segments were rated as "Medium" with traffic volumes increasing over the

current condition by approximately 100 or more vehicles per day on each segment. "Medium" risk indicates that conflicts would be expected to occur weekly on these segments. To summarize, the risk assessment for alternative 2 indicates that for road segments that currently have a high risk for wildlife-oversnow motorized conflicts, risks would remain high, and for segments where risk is currently considered low or medium, risks would increase to medium or high.

Several alternative actions and implementation features of this alternative serve to mitigate the increase in traffic volume on wildlife. Specifically, lower speed limits are proposed from the West Entrance to Madison and Old Faithful, late night travel is prohibited, and increased visitor education and ranger patrols would occur. In addition, when snow depth warrants and at periodic intervals, routine plowing operations would include laying back roadside snowbanks that could be a barrier to wildlife exiting the road corridor (an action common to all alternatives).

Effects of groomed roads and trails for motorized use. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative 2, YNP would groom 184 miles of motorized routes and GTNP and the Parkway would groom 35 miles of motorized routes, including the Grassy Lake Road and the CDST. Adaptive management would be employed in all alternatives to evaluate the effects of winter recreation on wildlife and to formulate management alternatives if necessary. Preliminary standards for adaptive management under alternative 2 are based on a determination of significant adverse effects that are considered "greater than negligible" as determined by NPS biologists.

The effects of groomed routes would increase slightly from alternative 1a due to the addition of the CDST. However because the CDST does not pass through elk or bison winter range, effects related to these particular species would not change. As stated in alternative 1a, whether or not groomed routes confer adverse impacts upon ungulate distributions and population dynamics is speculative and remains under investigation.

Conclusion

Overall, effects increase relative to alternative 1a because snowmobiles are allowed in the parks on all existing motorized routes except the Teton Park Road. Specifically, road kill mortality caused by oversnow vehicles would be greater (the occurrence is historically limited to snowmobiles only), risks associated with harassment and displacement would

increase, and physiological stress responses would rise due to higher traffic volumes. The importance assigned to these effects is in dispute and the ramifications inconclusive. Although winter recreation within the park has not clearly demonstrated any long term adverse consequences to populations, park policies, regulations, and Executive Orders clearly state that disturbance to wildlife, regardless of population-level effects, is unacceptable in the national parks. Under alternative 2, potential impacts to wildlife would be mitigated by lowering the speed limit to 35 mph from the West Entrance to Madison to Old Faithful, increasing ranger patrols, and offering education programs on winter use to all users.

Summary of Effects on Elk and Bison

Effects of motorized oversnow use on:

- mortality caused by collisions — adverse, negligible, and short term;
- harassment and displacement from preferred habitats — adverse, moderate, and short term;
- FGC levels — unknown to what extent stress may be affecting populations in the long-term. Effects are greater than alternative 1a due to the addition of snowmobiles.
- Effects of groomed roads and trails on animal movements — unknown if and to what extent beneficial effects outweigh negative effects.

The Effects of Implementing Alternative 3 on Wildlife

Ungulates (Elk and Bison)

Effects of motorized oversnow use. The use of motorized oversnow vehicles can cause injury and death for wildlife, habitat displacement, behavioral changes and physiological stress responses. Under alternative 3, these effects are associated with about 184 miles of groomed road surface in YNP and about 35 miles of groomed surfaces for motorized use in GTNP and the Parkway. In YNP, only snowcoaches would be allowed on certain groomed motorized routes (e.g., Fountain Flats Road) and snowmobile access would only be permitted when accompanied by an NPS permitted guide. The winter use season would run from late November to mid-March, with early season travel limited to snowcoaches until sufficient snow has accumulated, and late season travel (following Presidents' Day weekend) limited to snowcoaches and nonmotorized travel only. Oversnow travel would be prohibited from 8 PM to 7:30 AM, and in GTNP snowmobile use would not occur on the Teton Park road and the frozen surface of Jackson Lake.

Because the use of snowmobiles would be allowed in the parks under alternative 3, overall associated effects would be increased relative to alternative 1a. To assess the potential level of risk among the road segments by alternative, road segments in YNP were categorized as being of "High", "Medium" and "Low" risk for wildlife conflicts based on the YNP employee survey described in *Chapter III* (Table 20) and described under the wildlife analysis in alternative 1a of this document. Identified conflicts were associated with oversnow motorized use and included animals being herded down roadways, animals being prevented from crossing roads, and animals fleeing from oversnow motorized activities. For each road segment, risk was predicated on the perceived number of wildlife conflicts reported along each road segment and the projected average daily number of oversnow vehicles.

Relative to the four road segments currently rated as "High", all but one segment would remain "High" under alternative 3. "High" indicates that conflicts among wildlife and oversnow vehicles would be expected to continue to occur daily without mitigation. The exception is the segment from the West Entrance to Madison where the average number of vehicles would be reduced by 178 under this alternative. However the reduction in vehicles, and hence risk, along this segment may be made up for on other segments where the number of expected vehicles would rise due to redistributed use throughout the park. For example, risks increase from "Low" to "Medium" from Mammoth to Norris and West Thumb to Flagg as a result of increased traffic volume. For the remaining three segments currently rated as "Low", risk would remain "Low" in alternative 3 because traffic volumes would not be expected to significantly change.

Effects related to increased traffic volumes including disturbance and harassment would be mitigated by the stipulation that permitted guides accompany all snowmobilers in YNP. The use of guides would serve to minimize impacts by controlling where and when stops are made, and would prevent snowmobiles from becoming dispersed along the roadway. In addition, when snow depth warrants and at periodic intervals, routine plowing operations would include laying back roadside snowbanks that could be a barrier to wildlife exiting the road corridor (an action common to all alternatives).

Effects of groomed roads and trails for motorized use. Packed trails may influence wildlife movements and distributions by facilitating travel into areas that would normally be inaccessible due to deep snow. Under alternative 3, YNP would groom all existing routes (184 miles) and only snowcoaches would be allowed on certain side roads (e.g., Fountain

Flats Road). GTNP and the Parkway would groom 35 miles of motorized routes, including the Grassy Lake Road and the CDST. Adaptive management would be employed in all alternatives to evaluate the effects of winter recreation on wildlife and to formulate management alternatives if necessary. Preliminary standards for adaptive management under alternative 3 are based on a determination of adverse effects that are considered "greater than negligible" as determined by NPS biologists.

Similar to alternative 2, the effects of groomed routes would increase slightly from alternative 1a due to the addition of the CDST. However because the CDST does not pass through elk or bison winter range, effects related to these particular species would not change. As stated in alternative 1a, whether or not groomed routes confer adverse impacts upon ungulate distributions and population dynamics is speculative and remains under investigation.

Conclusion

Overall, effects increase relative to alternative 1a because snowmobiles are allowed in the parks on all major existing motorized routes except the Teton Park Road and Jackson Lake. Specifically, road kill mortality caused by oversnow vehicles would be greater (the occurrence is historically related to snowmobile use only), risks associated with harassment and displacement would increase, and physiological stress responses would rise due to higher traffic volumes. The importance assigned to these effects is in dispute and the ramifications inconclusive. Although winter recreation within the park has not clearly demonstrated any long term adverse consequences to populations, park policies, regulations, and Executive Orders clearly state that disturbance to wildlife, regardless of population-level effects, is unacceptable in the national parks. Under alternative 3, potential impacts to wildlife would be mitigated by permitting snowmobile access only when accompanied by an NPS permitted guide, restricting access on side roads to snowcoach only, and prohibiting nighttime oversnow travel. These features, along with fewer snowmobiles, decrease effects relative to alternative 2.

Summary of Effects on Elk and Bison

- Effects of motorized oversnow use on:
- mortality caused by collisions – adverse, negligible, and short term;
- harassment and displacement from preferred habitats – adverse, moderate, short term; and
- FGC levels — unknown to what extent stress may be affecting populations in the long-term. Greater than alternative 1a.

- Effects of groomed roads and trails on animal movements — unknown if and to what extent beneficial effects outweigh negative effects.

THE EFFECTS OF IMPLEMENTING THE ALTERNATIVES ON THE NATURAL SOUNDSCAPE

Summary of Changes in Impacts Between FEIS and SEIS

Specific impact estimates were calculated for the SEIS alternatives, corresponding to estimates for seven alternatives evaluated in the FEIS. For purposes of comparison, SEIS estimates are displayed below along with modeled results from alternatives A, B and D from the FEIS. Alternative A represents existing conditions and management, prior to implementation of the current decision. Alternatives B and D both prescribed objectives for quieter snowmobiles to address issues relating to impacts on the soundscape.

Table 77: Modeled sound impacts for SEIS alternatives compared to selected FEIS alternatives.

SEIS and FEIS Alternatives	Oversnow Road Segments where Average Noise level exceeds 50dB at 100 ft	Acres where Noise is Audible	Δ from existing
FEIS Alternative A (Existing Condition)	Average Noise Levels are highest due to oversnow use from W. Entrance to Old Faithful at 56dB, and on Jackson Lake at 58dB. Average noise level exceeding 50dB at 100ft is found at any point along 9 road segments, or on 144 miles of groomed road.	Less than 10% of the time: 200,700 More than 10% of the time:107,400 More than 50% of the time: 26,500	0% 0% 0%
SEIS Alternatives 1a and 1b	Average noise level does not exceed 50 dB at 100ft on any road segment. Level is highest due to oversnow use from W. Entrance to Old Faithful at 49dB.	Less than 10% of the time: 199,000 More than 10% of the time: 95,060 More than 50% of the time: 14,090	<-1% -11% -47%
SEIS Alternative 2	Average Noise Levels are highest due to oversnow use from W. Entrance to Old Faithful at 55-56dB. Average noise level exceeding 50dB at 100ft is found at any point along 12 road segments, or on 172 miles of groomed road.	Less than 10% of the time: 182,540 More than 10% of the time: 124,770 More than 50% of the time: 53,090	-9% +16% +100%
SEIS Alternative 3	Average Noise Levels are highest due to oversnow use from W. Entrance to Old Faithful at 54-55dB. Average noise level exceeding 50dB at 100ft is found at any point along 8 road segments, or on 134 miles of	Less than 10% of the time: 175,700 More than 10% of the time: 115,030 More than 50% of the	-12% +7% +37%

SEIS and FEIS Alternatives	Oversnow Road Segments where Average Noise level exceeds 50dB at 100 ft	Acres where Noise is Audible	Δ from existing
	groomed road.	time: 36,270	
FEIS Alternative B	Average Noise Levels are highest due to oversnow use from Old Faithful to Flagg Ranch at 50dB. Average noise level exceeding 50dB at 100ft is found at any point along 3 road segments, or on 51 miles of groomed road.	Less than 10% of the time: 149,600 More than 10% of the time: 68,300 More than 50% of the time: 16,400	-25% -36% -38%
FEIS Alternative D	Average Noise Levels are highest due to oversnow use from W. Entrance to Old Faithful at 43dB and on Jackson Lake at 54dB. Average noise level exceeding 50dB at 100ft is found only on Jackson Lake.	Less than 10% of the time: 119,800 More than 10% of the time: 62,800 More than 50% of the time: 14,900	-40% -42% -44%

Analysis Methods and Assumptions

Review of Differences Among Alternatives Relevant to Noise Modeling

Alternative 1a: This alternative has exactly the same inputs, assumptions and results as alternative G in the FEIS. For purposes relating to this analysis, all discussion of SEIS alternative 1b applies to alternative 1a as well.

Alternative 1b: This alternative has exactly the same inputs, assumptions and results as alternative G in the FEIS. No snowmobiles are present in this alternative, and an increased number of snowcoaches are assumed in their stead. Two types of snowcoaches are assumed, including the older Bombardier vehicles and the newer 4-track conversion van snowcoaches. Appendix A of the HMMH Report (January 2002) provides a breakdown of the vehicle volumes used in the modeling. There are no oversnow vehicles on several road segments (Mammoth to Northeast Entrance, Colter Bay to Moran Junction, Moran Junction to East Entrance, and Moran Junction to South Entrance), and the Teton Park Road, Antelope Flats and Jackson Lake are closed to all motor vehicles. In the models, snowmobiles are assumed to be traveling at a constant speed of 40 mph; and snowcoaches are assumed to be traveling at 30 mph in the modeling.

Alternative 2: Alternative 2 assumes a 75 dBA limit on the noise emissions (at 50 ft) of over-snow vehicles. It further assumes that the quietest available snowmobiles will be used; the noise emissions of those snowmobiles are 1.2 dBA lower than those used in the FEIS (details are given below). For snowcoaches, the same noise emissions and approximate ratio

of vehicle types were assumed as in alternative 1b (vehicle volumes are shown in Appendix A of the HMMH Report (January 2002)). One other difference in alternative 2 is that a 35 mph speed limit has been assumed for Segment 3 – West entrance to Madison and Segment 9 – Madison to Old Faithful therefore, snowmobiles were modeled at 35 mph instead of 40 mph, which was used for all other segments and alternatives. The snowmobile noise emission level at 35mph is about 0.7 dBA lower than at 40 mph. Snow coaches are still modeled at 30 mph. Of the road segments in alternatives 1a and 1b with no oversnow vehicles or no vehicles, in alternative 2 snowmobiles are modeled on the Colter Bay to Moran Junction and the Moran Junction to East Entrance segments.

Alternative 3: This alternative assumes the quietest available technology will be used for all oversnow vehicles. The noise emission for snowmobiles is 1.2 dBA lower than that modeled in the FEIS, the same as in alternative 2. For snowcoaches, only the 4-track conversion van vehicles were modeled in alternative 3, because they are the quietest available technology, with a sound level of 70 dBA at 50 ft, as compared with 75 dBA for the Bombardier. Speeds assumed for oversnow vehicles are the same as in alternatives 1a and 1b. Of the road segments in alternatives 1a and 1b with no oversnow vehicles or no vehicles, changes in alternative 3 include snowmobiles modeled on the Colter Bay to Moran Junction and the Moran Junction to East Entrance segments (see Appendix A of the HMMH report (January 2002) for vehicle volumes).

Oversnow vehicle noise emission levels

This section describes the selection of the vehicle noise emission levels that were used for modeling quietest available technology vehicles in alternatives 2 and 3. Since the FEIS was released, additional measurements of oversnow vehicles were conducted by Jackson Hole Scientific Investigations, Inc.[4] Data collected during these measurements were evaluated and used to support the selection of vehicle noise emission levels for the Draft Supplemental EIS. While both the data sets developed by Harris Miller Miller & Hanson Inc./Bowlby & Associates and by JHSI show a 1.2 dBA difference between average and quiet vehicles at a speed of 40 mph, that difference derives from measurements of a small number of quiet vehicles at a variety of speeds and conditions. Additional noise data will be collected in February 2002 to better quantify the noise emissions from the quietest available vehicles. This data will be reported and analyzed in the Final SEIS.

Oversnow vehicle measurements supporting the Draft and Final EIS

Harris Miller Miller & Hanson Inc. (HMMH) conducted controlled reference vehicle pass-bys of several oversnow vehicles during the winter 2000 sound measurement program conducted for the FEIS. Section 3.2.3 of the FEIS noise technical report describes the measurement procedures and results. Digital audio tape (DAT) recordings of constant-speed vehicle pass-bys at 50 ft were processed into 1/3 octave band spectra, resulting in the spectrum that occurs at the maximum A-weighted sound level. The measurements were conducted over snow typical of the parks in mid-winter, with ANSI Type I "Precision" Instrumentation. Measurements of three snowmobiles (one in two different gears) and five different snowcoaches were obtained at speeds ranging from 10 mph to 35 mph. All snowmobiles had 2-stroke engines.

Bowlby & Associates conducted A-weighted snowmobile pass-by measurements of several vehicles at different speeds in Grand Teton National Park in the winter of 1996[5]. The higher speed data from these measurements (45 to 55 mph) were used to supplement the HMMH measurements to develop a regression line of maximum pass-by level as a function of speed. This line and the data set supporting it are shown in Figure 33 in the FEIS noise technical report[6]. The regression line was used for the snowmobile sound levels in the model for the FEIS. All snowmobiles in the FEIS were modeled at a speed of 40 mph. The regression line crosses slightly above 73.9 dBA at 40 mph; a rounded level of 74 dBA was therefore used for the modeling of all snowmobiles. The spectrum shape chosen to represent this A-level was one of a 2000 Polaris 500 cc snowmobile pass-by at 35 mph (the maximum A-level of this particular pass-by was 72.4 dBA, so the entire spectrum was adjusted up by 1.6 dB therefore that it would sum to 74 dBA.).

HMMH's measurements of snowcoaches yielded the lowest sound levels for the gasoline-powered 4-track conversion van ("Mattrack") at 69.7 dBA (30 mph at 50 ft, rounded to 70 dBA for the analysis), and the highest for the Bombardier snowcoaches at 74.6 dBA (30 mph at 50 ft, rounded to 75 dBA for the analysis). A singular characteristic of the Bombardier snowcoach pass-by is a prominent tone at 160 Hz (at 35 mph). The regression lines for the measured A-weighted sound levels of these snowcoaches are shown as Figures 34 and 35 in the FEIS noise technical report.

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[4] "Over-snow Vehicle Sound Level Measurements, conducted for the Winter Use Plan SEIS for Yellowstone and Grand Teton National Parks and John D. Rockefeller, Jr. Memorial Parkway," prepared by Jackson Hole Scientific Investigations, Inc., September 2001.

[5] "1996 Noise monitoring study, Grand Teton National Park and John D. Rockefeller, Jr. Memorial Parkway," Prepared by Bowlby & Associates, Inc., 1996.

2001 Vehicle Measurements

Jackson Hole Scientific Investigations, Inc. (JHSI) conducted measurements of various over-snow vehicles in September 2001. Due to scheduling limitations, the measurements were conducted over grass instead of snow. Constant-speed pass-by measurements of 18 different snowmobiles and four snowcoaches were conducted at speeds of 20, 35 and 45 mph in accordance with SAE Standard J1161. The approach to these measurements was similar to HMMH's vehicle measurements, but a very significant difference was the ground type. Also, the measurement instrumentation was different. The instrument was an ANSI Type II (General Purpose") sound level meter, consistent with the type of instrumentation that would be used for vehicle noise enforcement. The sound level meter, a Quest Technologies M2100, collects A-weighted sound level data only, so no spectral data was obtained.

The sound level data for snowmobiles is summarized in Table 78 in the JHSI report. All two-stroke vehicle pass-bys are averaged, resulting in an sound level of 75.5 dBA at 35 mph and 77.3 dBA at 45 mph. The one four-stroke snowmobile measured 74.1 dBA at 35 mph and 76.2 dBA at 45 mph, quieter than any of the averages of sub-groups of two-stroke machines shown in the JHSI report. Therefore, the quiet 4-stroke machine was 1.4 dB quieter than the average two-stroke machine at 35 mph, and 1.1 dB quieter at 45 mph.

JHSI measured sound levels for snowcoaches also. At speeds of approximately 30 mph, the sound levels of the Bombardier, Mattrack 4-track conversion van and Ford full-track conversion van were nearly equal (with both sides averaged) at 78 to 79 dBA. The measured Mattrack van was a diesel-powered 1999 Chevrolet, whereas the previous HMMH study had measured a gasoline-powered Mattrack.

Measurement comparisons

Vehicle pass-by sound levels measured over grass are not directly comparable to pass-by levels measured over snow. The significant difference in the impedance of the ground surface (characterized as effective flow resistivity) would be expected to yield significant differences in the measured sound levels. This is due to the interference between the direct sound path and the sound path reflected from the ground; the effect of the softer snow is to reduce the sound level at the receiver. (Sound propagation is discussed in more detail in Section 3.2.2 of the FEIS noise technical report, and further in sound-propagation references given in that report.) Therefore, the JHSI measurements would be expected to be higher by

[6] "Technical Report on Noise:Winter Use Plan FEIS." HMMH Report #295860.18 June 2001.

several decibels than the measurements conducted over snow by HMMH and Bowlby & Associates (B&A). The exact difference in sound levels between sound propagation over snow and over grass depends strongly on both the height of the sound source(s) above the ground and on the frequency characteristics of the source. Therefore, without detailed information about the source heights and frequency content, it is not possible to compute accurately by how much the A-weighted sound level would differ over the two surfaces, and thereby "adjust" the JHSI data to over-snow conditions.

A possible additional difference between the JHSI measured data and the HMMH/B&A data is the increased friction on grass, especially for vehicles with skis in front. This may cause increased engine load and increased friction on the mechanical components of the sleds, resulting in greater noise (the JHSI report notes that track noise over grass seems louder than over snow).

Although the HMMH and B&A measured pass-by levels and the JHSI measured data are not directly comparable, the differences and trends internal to the JHSI measured data are of interest, as discussed below.

Snowmobiles

An average snowmobile sound level at 40 mph can be computed from the JHSI measurements of the 35 mph and 45 mph data. The average is 76.4 dBA for all of the two-stroke snowmobiles, and 75.2 dBA for the four-stroke snowmobile. Therefore, the quiet technology snowmobile was 1.2 dB quieter than the average snowmobile at 40 mph.

Because noise emission levels for quietest-available technology vehicles were needed for the Supplemental EIS modeling, the HMMH sound data were examined. Spectral data is needed in the modeling exercise (the JHSI study did not include spectral data), and over-snow measurements are preferred, so HMMH's data was selected. To establish a sound level for quietest-available technology snowmobiles at 40 mph, the quietest vehicles measured at 35 mph and 45 mph were chosen for averaging, since no appropriate 40 mph pass-by measurement was available. The lowest A-weighted sound levels are 71.5 dBA from a 2000 Polaris 500cc Wide Track measured by HMMH in 2000 in high gear at 35 mph, and 74 dBA for a snowmobile measured at 45 mph by B&A in 1996. The average value, to be used for the modeling of quietest-available technology snowmobiles at 40 mph is 72.8 dBA. Notably, this is 1.2 dB quieter than the average vehicle, the same average-to-minimum difference as

found in the JHSI study. The spectrum shape chosen to represent this A-level was the same as that used in the FEIS modeling of snowmobiles, adjusted downward by 1.2 dB.

Because speed will be limited to 35 mph in two segments under alternative 2, an appropriate sound level spectrum was also needed for snowmobiles at 35 mph. The spectrum measured from the 35 mph pass-by of the 2000 Polaris 500cc Wide Track in high gear was chosen; the maximum A-level of that pass-by was 71.5 dBA.

Snowcoaches

In addition to the Bombardier snowcoaches, HMMH measured only the gasoline-powered Mattrack 4-track conversion van over snow, and JHSI measured only the diesel-powered Mattrack van over grass. The diesel-powered van has a higher measured pass-by level, but because of the different ground types, the sound level data from these two vehicles cannot be directly compared[7].

The quietest measured snowcoach pass-by was the gasoline-powered Mattrack, measured by HMMH in 2000 over snow; the A-level was 70 dBA. This vehicle was modeled in the snowcoach fleet in the FEIS alternatives (In addition to the Bombardier). For alternative G in the FEIS, where more snowcoaches would be purchased, an approximate ratio of five times as many Mattrack snowcoaches were assumed as the older Bombardier coaches. This same mix has been assumed for alternatives 1b and 2 in the SEIS. For snowcoaches in alternative 3, which uses quietest available technology, only the gas-powered Mattracks were modeled.

Summary vehicle sound levels

Table 78 lists the A-weighted maximum pass-by sound levels that were used to model over-snow vehicles. Automobile and bus sound levels are unchanged from the FEIS, and are the same across all alternatives in the SEIS.

Table 78. Over-snow vehicle noise levels used in Draft Supplemental EIS.

Vehicle	Speed, mph	Sound Level at 50 ft over
Snowmobile	40	72.8
Snowmobile	35	71.5
4-Track (gas) Conversion Van	30	70
Bombardier Snowcoach	30	75

[7] Same day, same condition measurements of the diesel- and gasoline-powered Mattracks vans are planned in 2002 to determine if significant differences in the A-level and/or spectrum shape are present at 30 mph.

Vehicle Volumes and Roadway Segment Details

The average daily vehicle volumes used in the modeling are

in Appendix A of the noise technical report (HMMH January 2002). In brief, alternatives 1a and 1b use only snowcoaches, alternative 2 has both snowmobiles and snowcoaches, and alternative 3 is similar to alternative 2, but has fewer snowmobiles and more snowcoaches. There are also allowable speed differences on two segments in alternative 2, as noted above.

Table 79 provides the details on the segment lengths for each roadway, used in the computation of the number of acres of park land affected by vehicle noise. The table also lists the percentage of each road segment that was modeled as "open terrain" and as "forested terrain." Details on the soundscape characteristics of the different terrain types can be found in Section 2.4 of the FEIS noise technical report.

Table 79. Roadway segment lengths, percentage open and forested terrain.

Roadway Segment	Length [miles]	Percentage Open [%]	Percentage Forested [%]
1.Mammoth to northeast entrance	47	68	32
2.Mammoth to Norris	21	16	84
3.West entrance to Madison	14	3	97
4.Madison to Norris	14	5	95
5.Norris to Canyon Village	12	0	100
6.Canyon Village to fishing bridge	16	29	71
7.Fishing bridge to east entrance	27	17	83
8.Fishing bridge to West Thumb	21	50	50
9.Madison to Old Faithful	16	6	94
10. Old Faithful to West Thumb	17	0	100
11. West Thumb to Flagg Ranch	24	11	89
12. Grassy Lake Road	7.6	19	81
13. Flagg Ranch to Colter Bay	15.6	40	60
14. Colter Bay to Moran Junction	10.2	25	75
15. Moran Junction to east entrance	2	50	50
16. Moran Junction to south entrance	26	98	2
17. Teton Park Road	15	65	35
18. Moose-Wilson Road	2.5	63	37
19. Jackson Lake	9.7	100	0

Audibility of Single Events

Table 80 presents the computed distances to the limits of audibility of a single pass-by of each vehicle type over snow in the Open and Forested terrain for both the Average and Quiet background conditions. Distances are shown for different sized groups of snowmobiles, since such groups are common. The computations can be interpreted as follows: *beyond* the

distance shown, the vehicle would not be audible; *at* the distance shown, the vehicle would be barely audible for only a few seconds; *closer than* the distance shown, the vehicle would be more clearly audible and for longer.

Because the distances to audibility limits are based on the unique frequency characteristics of the sound sources, the background environments and the human auditory system, comparisons of the A-weighted sound levels alone will not lead to an understanding of differences. Differences in the distances between the average and quiet background conditions are small for snowmobiles, primarily because the frequency of maximum detection is 200 Hz, where the differences in background levels are smaller than the A-weighted sound level differences. The difference in distances between open terrain and forested terrain is generally larger because vehicle sound levels drop off more quickly with distance in the forested environment.

The shortest distances to the limits of audibility are generated by automobiles and by the 4-track conversion van snowcoaches. Reasons are that these vehicles are relatively quiet, they do not show tonal characteristics, and they produce relatively little low-frequency energy.

Table 80. Distances to limits of audibility for individual vehicle pass-bys over snow in open and forested terrain and in average and quiet background conditions.

Vehicle Type	Maximum 50 ft Pass-by Level (dBA)	Distance to Limit of Audibility (feet)			
		Open Terrain		Forested Terrain	
		Average Bkgrnd	Quiet Bckgrnd	Average Bkgrnd	Quiet Bkgrnd
Automobile	68	2,180	2,330	1,130	1,200
Bus	76	5,520	6,090	2,620	2,860
Bombardier Snowcoach	75	8,560	9,690	3,860	4,230
4-Track Conversion Van "Mattrack" Snowcoach	70	2,030	2,200	1,110	1,210
Snowmobile – Quiet Available	72.8	3,490	3,720	1,820	2,030
Group of 2 QA Snowmobiles	72.8 each	4,650	4,970	2,340	2,630
Group of 4 QA Snowmobiles	72.8 each	6,270	6,720	3,030	3,430
Group of 8 QA Snowmobiles	72.8 each	8,570	9,210	3,990	4,540
Group of 12 QA Snowmobiles	72.8 each	10,360	11,150	4,710	5,390

Distances to Audibility Metrics: Cumulative Effects of All Vehicles

The contributions from all vehicles during the day were accounted for, and distances to three metrics of audibility were computed, according to the approach described in Section 3 of the FEIS noise technical report. The three different audibility conditions are: 1) distance to the limit of audibility for all vehicles during the day, 2) distance to where vehicles would be audible 10% of the time or more, and 3) distance to where vehicles (if any) would be audible

50% of the time or more. Choosing these latter two metrics in addition to the distance to the limit of audibility metric allows the following questions to be answered: "How far do you have to go away from a road so that you won't hear snowmachine noise for more than 10% of the time throughout the day?" and "…for more than half the time?" Another parameter in considering audibility at a distance is the effect of multiple machines. The above table provides comparative figures for groups of machines; a group of 12 snowmobiles is expected to be audible at roughly three times the distance compared to a single snowmobile operating at the same individual pass-by level.

Effects of Alternatives on the Natural Soundscape

Tables 81 through 83 show the distances to audibility for each project alternative. These tables present the distances by road segment within which oversnow or wheeled vehicle sound would be audible under the two background conditions, average and quiet, and in the two terrain types. Where blanks exist in the tables, the vehicles on that segment would not meet that condition. It should be noted that there are no oversnow vehicles in Segments 1 and 14-17 in alternatives 1a and 1b, and no oversnow vehicles in Segments 1, 16 and 17 in alternatives 2 and 3. In those cases, the projected audibility is entirely due to autos, vans, and buses on plowed roads that do not change in any of the alternatives.

Table 81. Distances to Audibility (feet): Alternatives 1a and 1b.

Road Segment	Average background Open terrain			Average background Forested terrain			Quiet background Open terrain			Quiet background Forested terrain		
	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more
Mammoth to Northeast Entrance	3,276	1,406		1,884			3,398	1,637		2,007		
Mammoth to Norris	9,003	1,593		3,744			10,757	3,008		3,906		
West Entrance to Madison	17,810	14,213	8,501	6,210	3,843		21,138	17,244	10,929	6,933	4,404	
Madison to Norris	12,839	9,354		4,953	2,555		14,612	11,603		5,605	3,112	
Norris to Canyon Village	11,846	8,296		3,947	709		13,523	10,389		4,563	1,731	
Canyon Village to Fishing	10,110	7,882		3,774			12,108	9,817		3,939		

Road Segment	Average background Open terrain			Average background Forested terrain			Quiet background Open terrain			Quiet background Forested terrain		
	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more
Bridge												
Fishing Bridge to East Entrance	8,413			3,727			9,949			3,889		
Fishing Bridge to West Thumb	9,535	7,221	4,091	3,749	3,035		11,044	7,963	4,939	3,915	3,320	
Madison to Old Faithful	17,810	14,079	7,473	6,210	3,804		21,138	17,067	10,057	6,933	4,257	
Old Faithful to West Thumb	12,197	8,688		4,953	2,340		13,735	10,807		5,605	2,872	
West Thumb to Flagg Ranch	11,846	8,258		3,947	496		13,523	10,362		4,563	1,662	
Grassy Lake Road	3,537			2,122			3,666			2,376		
Flagg Ranch to Colter Bay	11,846	8,258		3,947	496		13,523	10,362		4,563	1,662	
Colter Bay to Moran Junction	5,642	2,949		3,058	985		6,281	3,121		3,219	1,159	
Moran Junction to east entrance	6,856	4,132	3,245	3,249	2,079	801	7,428	4,843	3,466	3,453	2,274	947
Moran Junction to south entrance	6,965	4,663	3,580	3,232	2,150	1,031	7,650	5,432	3,803	3,393	2,322	1,258
Teton Park Road	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Moose-Wilson Road	2,669			1,336			2,785			1,454		
Jackson Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 82. Distances to audibility (feet): alternative 2.

Road Segment	Average background Open terrain			Average background Forested terrain			Quiet background Open terrain			Quiet background Forested terrain		
	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more
Mammoth to Northeast Entrance	3,276	1,406		1,884			3,398	1,637		2,007		
Mammoth to Norris	8,632	3,990		3,736	2,193		10,178	4,714		3,900	2,497	
West Entrance to Madison	12,459	10,707	7,909	3,940	3,416	2,715	14,068	12,151	9,251	4,697	3,725	3,117
Madison to Norris	10,048	7,890	5,915	3,789	3,079	1,414	11,462	9,167	6,757	3,963	3,393	1,996
Norris to Canyon Village	9,580	6,841	3,970	3,779	2,900		11,099	7,604	4,761	3,952	3,202	1,081
Canyon Village to Fishing Bridge	8,947	6,226	3,332	3,743	2,821		10,540	6,987	3,841	3,909	3,111	
Fishing Bridge to East Entrance	7,839	5,497	2,738	3,391	2,711		8,814	6,204	3,277	3,634	2,994	
Fishing Bridge to West Thumb	8,779	5,711	2,572	3,739	2,736		10,323	6,473	3,148	3,903	3,023	
Madison to Old Faithful	13,443	11,869	9,558	4,076	3,616	2,918	14,907	13,254	10,941	5,118	3,935	3,339
Old Faithful to West Thumb	9,958	7,273	4,724	3,793	2,969	900	11,387	8,087	5,603	3,968	3,276	1,511
West Thumb to Flagg Ranch	11,447	9,258	7,289	3,850	3,292	2,530	12,584	10,564	8,235	4,408	3,602	2,937
Grassy Lake Road	5,792	3,164		3,126	677		6,411	3,384		3,297	1,212	
Flagg Ranch to Colter Bay	7,173	4,385		3,288	2,250		7,791	5,116		3,518	2,579	
Colter Bay to Moran Junction	7,333	4,792	2,516	3,278	2,349		7,964	5,524	2,903	3,514	2,666	
Moran Junction to East entrance	8,085	5,851	3,839	3,403	2,566	1,130	9,234	6,603	4,260	3,638	2,855	1,477

Road Segment	Average background Open terrain			Average background Forested terrain			Quiet background Open terrain			Quiet background Forested terrain		
	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more
Moran Junction to South Entrance	6,965	4,663	3,580	3,232	2,150	1,031	7,650	5,432	3,803	3,393	2,322	1,258
Teton Park Road	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Moose-Wilson Road	2,669			1,336			2,785			1,454		
Jackson Lake	5,782	2,069		3,125			6,400	2,485		3,295		

Table 83. Distances to audibility (feet): alternative 3.

Road Segment	Average background Open terrain			Average background Forested terrain			Quiet background Open terrain			Quiet background Forested terrain		
	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more
Mammoth to Northeast Entrance	3,276	1,406		1,884			3,398	1,637		2,007		
Mammoth to Norris	8,632	3,990		3,736	2,193		10,178	4,714		3,900	2,497	
West entrance to Madison	13,785	11,429	7,249	5,219	3,581	1,812	15,830	13,399	8,485	5,952	3,860	2,380
Madison to Norris	11,295	8,037	4,358	3,907	3,029	708	13,144	9,599	5,257	4,430	3,340	1,375
Norris to Canyon Village	8,954	5,907	2,882	3,749	2,770		10,498	6,671	3,430	3,916	3,059	
Canyon Village to Fishing Bridge	8,721	5,232	1,182	3,738	2,457		10,287	5,989	2,019	3,902	2,768	
Fishing Bridge to East Entrance	6,572	3,886		3,197	2,154		7,167	4,202		3,393	2,455	
Fishing Bridge to West Thumb	8,654	4,768		3,736	2,290		10,205	5,538		3,900	2,622	
Madison to Old Faithful	14,363	12,734	9,597	5,356	3,728	2,900	16,811	14,410	11,165	6,133	4,098	3,307
Old Faithful to West Thumb	9,435	6,345	3,443	3,770	2,829		11,123	7,115	3,942	3,939	3,120	
West Thumb to Flagg Ranch	10,336	8,072	6,224	3,816	3,113	1,546	11,984	9,450	7,061	3,994	3,427	2,124
Grassy Lake Road	6,413	3,768		3,197	2,106		6,977	3,920		3,383	2,393	
Flagg Ranch to Colter Bay	6,413	3,768		3,197	2,106		6,977	3,920		3,383	2,393	
Colter Bay to Moran Junction	6,510	3,901	1,533	3,176	2,160		7,109	4,266	1,940	3,397	2,448	

Road Segment	Average background Open terrain			Average background Forested terrain			Quiet background Open terrain			Quiet background Forested terrain		
	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more	Audible at all	Audible 10% or more	Audible 50% or more
Moran Junction to east entrance	7,113	5,160	3,563	3,236	2,396	934	7,721	5,900	3,798	3,455	2,661	1,193
Moran Junction to south entrance	6,965	4,663	3,580	3,232	2,150	1,031	7,650	5,432	3,803	3,393	2,322	1,258
Teton Park Road	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Moose-Wilson Road	2,669			1,336			2,785			1,454		
Jackson Lake	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Acres of Affected Park Land

The previous section contains tables with distances to audibility metrics for each segment and each alternative. The following section presents the area of park land in acres where any vehicle noise would be audible under the two background conditions, average and quiet. The areas shown in this section are computed by multiplying the distances to audibility presented in the previous section by each roadway segment length. Segment lengths and their percentages of open and forested terrain are presented in Table 80.For each background condition, acreage is presented for three categories of audibility: (1) audible for any amount of time (labeled "Audible at all"), (2) audible for 10% of the time or more, and (3) audible for 50% of the time or more.

Alternatives 1a and 1b: Effects by roadway segment

Table 84 through Table 86 below provide details on the affected acreage for each roadway segment and project alternative, showing where this acreage occurs. For alternatives 1a and 1b, of particular note is the limited acreage in the parks where snowmachines would be heard 50% of the time or more. Only along the plowed road segment between Moran Junction and the South Entrance, where only wheeled vehicles are allowed, are there a significant number of acres affected.

If the acres for the Moran Junction to South Entrance segment were removed (because wheeled vehicles on this plowed road segment are not affected by the SEIS alternatives), total acreages shown for alternatives 1a and 1b would change. The following table compares areas affected with and without wheeled vehicles.

Table 84. Comparison of total acres affected where vehicles would be audible, alternatives 1a and 1b, separating out wheeled vehicle impacts.

Impacts on Segments:	Acres of affected Park land where vehicles would be audible					
	Average background conditions			Quiet background conditions		
	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
Including wheeled-vehicle impacts	178,445	74,795	12,916	199,062	95,060	14,087
Without wheeled-vehicle traffic	156,731	60,259	1,793	175,220	78,138	2,262

The most dramatic changes due to removing the plowed road segment are in the columns for audible 50% or more, where that segment is the only one with significant acreage. Also, the most dramatic differences between the alternatives are also evident in those columns, areas that could be considered to have the greatest impact. In the 50% or more audible categories, alternatives 1a and 1b have by far the least number of acres.

It should be noted that there are no oversnow vehicles in Segments 1 and 14-16 in alternatives 1a and 1b. In those cases, the projected audibility is entirely due to autos, vans and buses, which do not change in any of the alternatives.

Table 85. Acres of Affected Park Land Where Vehicles Would Be Audible: Alternatives 1a and 1b.

Road Segment	Acres of affected Park land where vehicles would be audible					
	Average background conditions			Quiet background conditions		
	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
Mammoth to Northeast Entrance	16,126	5,445	0	16,822	6,342	0
Mammoth to Norris	11,671	649	0	12,734	1,225	0
West Entrance to Madison	11,129	7,049	433	12,487	8,128	556
Madison to Norris	9,075	4,913	0	10,275	6,002	0
Norris to Canyon Village	5,740	1,031	0	6,637	2,518	0
Canyon Village to Fishing Bridge	10,883	4,433	0	12,233	5,521	0
Fishing Bridge to East Entrance	14,805	0	0	16,100	0	0

Road Segment	Acres of affected Park land where vehicles would be audible					
	Average background conditions			Quiet background conditions		
	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
Fishing Bridge to West Thumb	17,671	10,032	0	20,423	12,495	0
Madison to Old Faithful	13,393	8,573	870	15,098	9,746	1,170
Old Faithful to West Thumb	10,207	4,822	0	11,549	5,918	0
West Thumb to Flagg Ranch	14,008	3,926	0	16,141	7,618	0
Grassy Lake Road	2,122	0	0	2,376	0	0
Flagg Ranch to Colter Bay	13,437	6,808	0	15,405	9,723	0
Colter Bay to Moran Junction	4,579	1,825	0	4,926	2,040	0
Moran Junction to east entrance	1,225	753	490	1,319	863	535
Moran Junction to south entrance	21,714	14,536	11,123	23,842	16,922	11,825
Teton Park Road	Closed	Closed	Closed	Closed	Closed	Closed
Moose-Wilson Road	659	0	0	695	0	0
Jackson Lake	Closed	Closed	Closed	Closed	Closed	Closed
TOTALS	**178,445**	**74,795**	**12,916**	**199,062**	**95,060**	**14,087**

Alternatives 1a and 1b feature no motorized vehicles of any type on Jackson Lake, Teton Park Road and the Antelope Flats snowmobile trail in GTNP. These alternatives also feature snowcoaches instead of snowmobiles in YNP, and allow snowcoaches from Colter Bay to Flagg Ranch along the Parkway. Wheeled traffic would be on the road from Colter Bay to Moran Junction, and from Moran Junction to the South and East Entrances of GTNP, along with a few cars on the Moose-Wilson Road.

The results for alternatives 1a and 1b show that for the average background sound level condition, wheeled or oversnow vehicles would be audible to some degree for just over 178,000 acres in the three park units. For over 74,000 of those acres, wheeled or oversnow vehicles would be audible for at least 10% of the daytime hours (8 a.m. to 6 p.m.) for the average background condition. For nearly 13,000 of those acres, they would be audible for at least half (50%) of the daytime hours for the average background condition. For the Quiet background conditions, these acreage totals would increase by 12%, 27% and 9% for the three audibility cases, respectively, compared to the Average condition.

The segment from Moran Junction to the South Entrance of GTNP would contribute the greatest amount to the total acreage values for all three audibility categories and both

background conditions. This segment, along with the segment from Moran Junction to the East Entrance of GTNP, would carry a great deal of "through" wheeled vehicle traffic unrelated to the Winter Use Plan alternatives. In the case of the "audible for 50% of the time or more" category, these two segments represent nearly 90% of the affected acreage for these alternatives. For the "audible for 10% of the time or more" category, these two segments represent nearly 20% of the affected acreage. For "audible at all," they represent 12% of the affected acreage.

The plowed road from Mammoth to the YNP Northeast Entrance would be a major contributor to the "audible at all" acreage (and, to a lesser extent, "audible 10% or more"). The traffic volumes on this road and affected acreage would be the same for all four alternatives being analyzed.

The major contributors to the "audible at all" acreage for the over-snow segments would include Fishing Bridge-West Thumb, Fishing Bridge-East Entrance of Yellowstone, West Thumb-Flagg Ranch, Madison-Old Faithful, and Flagg Ranch-Colter Bay.

For the "audible 10% or more" categories, the major oversnow contributors would include Fishing Bridge-West Thumb, Madison-Old Faithful, West Entrance, Madison, and Flagg Ranch-Colter Bay. There would be zero acreage for the Fishing Bridge-East Entrance and Grassy Lake Road segments because of the low numbers of snowcoaches.

The only oversnow segments in the "audible 50% or more" categories would be from the West Entrance to Madison and from Madison to Old Faithful, caused by the large number of snowcoaches on these two segments.

Alternative 2: Effects by roadway segment

In alternative 2, while the number of total acres affected where vehicles would be audible at all is less than for alternative 1b, the number of acres affected where vehicles would be heard 10% of the time or 50% of the time or more is much greater than for alternative 1b. This result is due the significantly greater number of vehicles present in alternative 2.

If the acres for the Moran Junction to south entrance segment were removed (because wheeled vehicles on this plowed road segment are not affected by the SEIS alternatives), total acreages shown for alternative 2 would change. The following table compares acres affected with and without wheeled vehicles.

Table 86. Comparison of total acres affected where vehicles would be audible in alternative 2, separating out wheeled vehicle impacts.

Impacts on Segments:	Acres of affected Park land where vehicles would be audible					
	Average background conditions			Quiet background conditions		
	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
Including wheeled-vehicle impacts	165,711	110,490	43,996	182,544	124,773	53,087
Without wheeled-vehicle traffic	143,997	95,954	32,873	158,702	107,851	41,262

The most dramatic differences between alternative 2 and the other alternatives caused by removing the segment, are in the columns for 50% or more audibility, areas which could be considered to have the greatest impact. In those areas, alternative 2 has by far the greatest number of acres affected.

It should be noted that there are no oversnow vehicles in Segments 1 and 16 in alternative 2. In those cases, the projected audibility is entirely due to autos, vans and buses, which do not change in any of the alternatives.

Table 87. Acres of affected park land where vehicles would be audible: alternative 2.

Road Segment	Acres of affected Park land where vehicles would be audible					
	Average background conditions			Quiet background conditions		
	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
Mammoth to Northeast Entrance	16,126	5,445	0	16,822	6,342	0
Mammoth to Norris	11,504	6,314	0	12,483	7,259	0
West Entrance to Madison	7,120	6,168	4,872	8,448	6,750	5,602
Madison to Norris	6,961	5,633	2,781	7,362	6,247	3,792
Norris to Canyon Village	5,497	4,218	0	5,748	4,657	1,573
Canyon Village to Fishing Bridge	10,186	7,386	1,874	11,310	8,213	2,160
Fishing bridge to East Entrance	13,573	10,423	1,523	14,774	11,584	1,823
Fishing Bridge to West Thumb	15,932	10,752	3,274	18,106	12,086	4,006

Road Segment	Acres of affected Park land where vehicles would be audible					
	Average background conditions			Quiet background conditions		
	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
Madison to Old Faithful	8,994	7,973	6,432	11,066	8,715	7,359
Old Faithful to West Thumb	7,816	6,117	1,855	8,177	6,750	3,113
West Thumb to Flagg Ranch	13,632	11,485	8,882	15,439	12,706	10,240
Grassy Lake Road	3,346	1,059	0	3,582	1,497	0
Flagg Ranch to Colter Bay	9,156	5,870	0	9,884	6,795	0
Colter Bay to Moran Junction	5,306	3,659	778	5,721	4,179	897
Moran Junction to East Entrance	1,392	1,020	602	1,560	1,146	695
Moran Junction to South Entrance	21,714	14,536	11,123	23,842	16,922	11,825
Teton Park Road	Closed	Closed	Closed	Closed	Closed	Closed
Moose-Wilson Road	659	0	0	695	0	0
Antelope Flats snowmobile route	Closed	Closed	Closed	Closed	Closed	Closed
Jackson Lake	6,798	2,433	0	7,525	2,921	0
TOTALS	**165,711**	**110,490**	**43,996**	**182,544**	**124,773**	**53,087**

Alternative 2 features no motorized vehicles of any type on Teton Park Road and the Antelope Flats snowmobile trail in GTNP. Snowmobiles would be allowed, however, on Jackson Lake. For alternative 2, large numbers of snowmobiles would replace most or all of the comparatively fewer snowcoaches in alternatives 1a and 1b for all of the oversnow segments (all of the snowcoaches would be replaced between Fishing Bridge and the East Entrance of YNP, along Grassy Lake Road , and from Flagg Ranch to Colter Bay). Snowmobiles would be allowed in addition to wheeled vehicles between Colter Bay and Moran Junction, and from Moran Junction to the South and East Entrances of GTNP. The wheeled traffic volumes road from Colter Bay to Moran Junction, from Moran Junction to the South and East Entrances of GTNP, and on the Moose-Wilson Road would remain the same as for alternatives 1a and 1b.

For the average background sound level condition, wheeled or oversnow vehicles would be audible to some degree for just over 165,000 acres in the three park units, or about 7% less

than in alternatives 1a or 1b. Hidden within that percentage are decreases of 23%-36% on five segments: West Entrance to Madison, Madison to Old Faithful, Flagg Ranch to Colter Bay, Madison to Norris, and Old Faithful to West Thumb. Also hidden within that percentage are increases of just over 50% for Grassy Lake Road and from zero acres to around 7,000 acres for Jackson Lake.

For the average background condition, wheeled or over-snow vehicles would be audible for at least 10% of the daytime hours for just over 110,000 acres, or 48% more than in alternatives 1a or 1b. Vehicles would be audible for at least 50% of the daytime hours for the average background condition for 44,000 acres, or nearly 3.5 times as much as alternatives 1a or 1b.

For the quiet background conditions, the alternative 2 acreage totals would increase by 10%, 13%, and 21% for the three audibility cases, respectively, compared to the average condition for alternative 2. Compared to alternatives 1a and 1b, the quiet background "audible at all" acreage would be reduced 8%. The "audible for 10% of the time or more" acreage would increase by 31% for the quiet background, and the "audible for 50% of the time or more" acreage would increase by 377%.

As with alternatives 1a or 1b, the segment from Moran Junction to the South Entrance of GTNP would contribute the greatest amount to the total acreage values for all three audibility categories and both background conditions. This segment along with the segment from Moran Junction to the East Entrance of GTNP would carry a great deal of "through" wheeled vehicle traffic unrelated to the alternatives. The traffic volumes and affected acreage for these segments would be the same as for alternatives 1a or 1b.

However, in the case of the "audible for 50% of the time or more" category, these two segments would represent only about a quarter of the affected acreage for alternative 1b, compared to nearly 90% for alternatives 1a or 1b. The reason for the large difference is the fact that in alternative 2, many of the oversnow segments would now have acreage in this category due to the presence of the large number of snowmobiles. For the "audible for 10% of the time or more" category, these two Moran Junction segments would represent about 14% of the affected acreage (compared to nearly 20% for Alternatives 1 or 2). For "audible at all," they would also represent 14% of the affected acreage (compared to 12% for alternatives 1a or 1b).

As with alternatives 1a or 1b, the plowed road from Mammoth to the Yellowstone Northeast Entrance would be a major contributor to the "audible at all" acreage (and, to a lesser extent, "audible 10% or more") for alternative 2.

The major contributors to the "audible at all" acreage for the oversnow segments would include Fishing Bridge-West Thumb, Fishing Bridge-East Entrance of Yellowstone, West Thumb-Flagg Ranch, Mammoth-Norris, and Canyon Village-Fishing Bridge.

For the "audible 10% or more" categories, the major oversnow contributors would include West Thumb-Flagg Ranch (a relatively minor contributor for alternatives 1a or 1b), Fishing Bridge-West Thumb, and Fishing Bridge-East Entrance of Yellowstone. The latter would have zero acreage for alternatives 1a or 1b (as would Grassy Lake Road, which would have over 1,000 acres for alternative 2, and Jackson Lake, which would have over 2,000 acres for alternative 1b). Other segments with major increases in acreage in the "audible 10% or more" category would include: Mammoth to Norris (873% increase for average background, 493% for quiet background), Norris to Canyon Village (309% increase for average, 85% for quiet) and Colter Bay to Moran Junction (100% increase for average, 105% for quiet). Segments with decreases in affected acreage compared to alternatives 1a or 1b would include: West Entrance to Madison, Madison to Old Faithful, and Flagg Ranch to Colter Bay.

For the "audible 50% or more" categories, nearly all of the oversnow segments that would have zero acreage for alternatives 1a or 1b would have affected acreage for alternative 2. The exceptions would be Mammoth to Norris, Grassy Lake Road, Flagg Ranch to Colter Bay, and Jackson Lake, which would all still have zero acreage in this category. The major over-snow contributors for this category would be West Thumb to Flagg Ranch, Madison to Old Faithful, and YNP's West Entrance to Madison.

Alternative 3: Effects by roadway segment

Alternative 3 has the lowest number of total acres affected where vehicles would be audible at all. However, the number of acres affected where vehicles would be heard 10% of the time or 50% of the time or more is much greater than for alternatives 1a or 1b. This result is due to the significantly greater number of vehicles present. Alternative 3 has fewer acres affected than alternative 2 due to the somewhat lower total volume of vehicles.

If the acres for the Moran Junction to south entrance segment were removed (because wheeled vehicles on this plowed road segment are not affected by the SEIS alternatives),

total acreages shown for alternative 2 would change. The following table compares acres affected with and without wheeled vehicles.

Table 88. Comparison of total acres affected where vehicles would be audible in alternative 3, separating out wheeled vehicle impacts.

Impacts on Segments:	Acres of affected Park land where vehicles would be audible					
	Average background conditions			Quiet background conditions		
	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
Including wheeled-vehicle impacts	160,758	102,033	30,070	175,705	115,034	36,265
Without wheeled-vehicle traffic	139,044	87,497	18,947	151,863	98,112	24,440

The most dramatic differences between alternative 3 and the other alternatives from removing the segment are in the columns for 50% or more audibility, areas that could be considered to have the greatest impact. Alternative 3 has fewer acres than alternative 2 in those columns, but still far more than alternatives 1a and 1b.

It should be noted that there are no oversnow vehicles in Segments 1 and 16 in alternative 3. In those cases, the projected audibility is entirely due to autos, vans and buses, and does not change in any of the alternatives.

Table 89. Acres of Affected Park Land Where Vehicles Would Be Audible: Alternative 3.

Road Segment	Acres of affected Park land where vehicles would be audible					
	Average background conditions			Quiet background conditions		
	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
Mammoth to Northeast Entrance	16,126	5,445	0	16,822	6,342	0
Mammoth to Norris	11,504	6,314	0	12,483	7,259	0
West Entrance to Madison	9,292	6,476	3,352	10,603	7,035	4,350

Road Segment	Acres of affected Park land where vehicles would be audible					
	Average background conditions			Quiet background conditions		
	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
Madison to Norris	7,256	5,565	1,512	8,257	6,199	2,662
Norris to Canyon Village	5,453	4,030	0	5,695	4,450	0
Canyon Village to Fishing Bridge	10,052	6,326	665	11,159	7,181	1,135
Fishing Bridge to East Entrance	12,341	8,013	0	13,205	9,006	0
Fishing Bridge to West Thumb	15,770	8,983	0	17,952	10,386	0
Madison to Old Faithful	11,436	8,279	6,404	13,137	9,148	7,328
Old Faithful to West Thumb	7,769	5,828	0	8,116	6,430	0
West Thumb to Flagg Ranch	13,189	10,644	5,995	14,176	11,897	7,760
Grassy Lake Road	3,508	2,231	0	3,745	2,472	0
Flagg Ranch to Colter Bay	8,478	5,239	0	9,115	5,680	0
Colter Bay to Moran Junction	4,957	3,209	474	5,348	3,588	600
Moran Junction to East Entrance	1,254	916	545	1,355	1,038	605
Moran Junction to South Entrance	21,714	14,536	11,123	23,842	16,922	11,825

Road Segment	Acres of affected Park land where vehicles would be audible					
	Average background conditions			Quiet background conditions		
	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more	Audible at all	Audible 10% of the time or more	Audible 50% of the time or more
Teton Park Road	Closed	Closed	Closed	Closed	Closed	Closed
Moose-Wilson Road	659	0	0	695	0	0
Jackson Lake	Closed	Closed	Closed	Closed	Closed	Closed
TOTALS	**160,758**	**102,033**	**30,070**	**175,705**	**115,034**	**36,265**

Alternative 3 features no motorized vehicles of any type on Jackson Lake, Teton Park Road and the Antelope Flats snowmobile trail in GTNP. Alternative 3 assumes no Bombardier snowcoaches (only Mattracks), and fewer numbers of snowmobiles than alternative 2 on many of the oversnow segments. There is also a much greater number of snowcoaches from the West entrance to Madison, and from Madison to Old Faithful, compared to alternative 2, although the number is much less than for alternatives 1a or 1b. As with alternative 2, snowmobiles would be allowed in addition to wheeled vehicles between Colter Bay and Moran Junction, and from Moran Junction to the South and East Entrances of GTNP. The wheeled traffic volumes from Colter Bay to Moran Junction, from Moran Junction to the South and East Entrances of GTNP, and on the Moose-Wilson Road would remain the same as for the other alternatives.

For the average background sound level condition, wheeled or over-snow vehicles would be audible to some degree for just over 160,000 acres in the three park units, or about 10% less than in alternatives 1a and 1b. Hidden within that percentage are decreases of 15-41% on five segments: West Entrance to Madison, Madison to Old Faithful, Flagg Ranch to Colter Bay, Madison to Norris, and Old Faithful to West Thumb. Also hidden within that percentage is an increase of approximately 60% for Grassy Lake Road. For the average background condition, wheeled or over-snow vehicles would be audible for at least 10% of the daytime hours for just over 102,000 acres, or 36% more than in alternatives 1a and 1b. Vehicles would be audible for at least 50% of the daytime hours for the average background condition for 30,000 acres, or just under 2.5 times as much as in alternatives 1a and 1b.

For the quiet background conditions, the alternative 3 acreage totals would increase by 9%, 13% and 21% for the three audibility cases, respectively, compared to the average condition

for alternative 3. Compared to alternatives 1a or 1b, the quiet background "audible at all" acreage would be reduced 12%. The "audible for 10% of the time or more" acreage would increase by 21% for the quiet background, and the "audible for 50% of the time or more" acreage would increase by 257%.

As with the other alternatives, the segment from Moran Junction to the South Entrance of GTNP would contribute the greatest amount to the total acreage values for all three audibility categories and both background conditions. This segment along with the segment from Moran Junction to the East Entrance of GTNP would carry a great deal of "through" wheeled vehicle traffic unrelated to the alternatives. The traffic volumes and affected acreage for these segments would be the same as for the other alternatives.

However, in the case of the "audible for 50% of the time or more" category, these two segments would represent just over a third of the affected acreage for alternative 3, compared to nearly 90% for alternatives 1a and 1b. As with alternative 2, the reason for the large difference is the fact that in alternative 3, many of the oversnow segments would now have acreage in this category due to the presence of the large number of snowmobiles. For the "audible for 10% of the time or more" category, these two Moran Junction segments would represent 15%-16% of the affected acreage (compared to nearly 20% for alternatives 1a or 1b). For "audible at all," they would also represent 14% of the affected acreage (compared to 12% for alternatives 1a or 1b).

As with all other alternatives, the plowed road from Mammoth to YNP's Northeast Entrance would be a major contributor to the "audible at all" acreage (and, to a lesser extent, "audible 10% or more") for alternative 3.

The major contributors to the "audible at all" acreage for the oversnow segments in alternative 3 would include Fishing Bridge-West Thumb, Fishing Bridge-East Entrance of YNP, West Thumb-Flagg Ranch, Mammoth-Norris, and Madison-Old Faithful.

For the "audible 10% or more" categories, the major oversnow contributors would include West Thumb-Flagg Ranch (a relatively minor contributor for alternatives 1a and 1b), Fishing Bridge-West Thumb, Madison-Old Faithful, and Fishing Bridge-East Entrance of YNP. The latter would have zero acreage for alternatives 1a and 1b (as would Grassy Lake Road, which would have over 2,000 acres for alternative 3). Other segments with major increases in acreage in the "audible 10% or more" category compared to alternatives 1a and 1b would include: Mammoth to Norris (873% increase for average background, 493% for quiet

background), Norris to Canyon Village (291% increase for average, 77% for quiet), West Thumb to Flagg Ranch (171% increase for average, 56% for quiet), and Colter Bay to Moran Junction (76% increase for both average and quiet). Segments with decreases in affected acreage compared to alternatives 1a and 1b would include: YNP's West Entrance-Madison, Madison to Old Faithful, Fishing Bridge to West Thumb and Flagg Ranch to Colter Bay.

For the "audible 50% or more" categories, several of the oversnow segments that would have zero acreage in alternatives 1a or 1b would have affected acreage for alternative 3. As with alternative 2, the major ones would be West Thumb to Flagg Ranch, Madison to Old Faithful, and YNP's West Entrance-Madison.

Average Sound Levels

To permit an evaluation of the average magnitude of the noise from wheeled and oversnow vehicle traffic, the modeling effort included computations of the hourly equivalent or "average" sound level (L_{eq}) over the day. Levels are shown for the three alternatives in Tables 90 through 92 for each road segment at two distances, 100 ft and 4000 ft, and for both open and forested terrain.

These hourly L_{eq} values do not have the background sound level added into them. Also, they cannot be compared against the background levels to assess audibility, since L_{eq} represents a long term average of both quiet and loud moments.

L_{eq} is an energy-based metric, therefore, if only a single snowmobile with a maximum level of 70 dBA passed by a site 100 feet from a trail during in an entire hour, the L_{eq} for that hour at that site would be approximately 40-45 dBA. If ten 70-dBA snowmobiles passed by instead of one, the L_{eq} would be 10 decibels higher, about 50-55 dBA.

Table 90 shows that the hourly L_{eq} at 100 feet are highest for the West Entrance-Madison and Madison-Old Faithful segments. Overall, the L_{eq} values are significantly lower for alternatives 1a and 1b (5 to 10 dB) at 100 ft as compared to alternatives 2 and 3 for the YNP road segments where the snowmobiles would be replaced with snowcoaches. At 4,000 feet away, the L_{eq} values are also highest for the West Entrance-Madison and Madison-Old Faithful segments, as well as the segments from Moran Junction to both the East Entrance and the South Entrance of GTNP.

Table 90. Average Hourly L_{eq} from Vehicular Noise at Two Distances from Each Road Segment: Alternatives 1a and 1b.

Road segment	Leq at distance (dBA)			
	Open terrain		Forested terrain	
	100 ft	4000 ft	100 ft	4000 ft
Mammoth to Northeast Entrance	35	2	33	0
Mammoth to Norris	42	6	40	0
West Entrance to Madison	49	15	47	7
Madison to Norris	46	12	44	4
Norris to Canyon Village	44	10	43	2
Canyon Village to Fishing Bridge	43	9	42	1
Fishing Bridge to East Entrance	36	2	35	0
Fishing Bridge to West Thumb	43	9	41	1
Madison to Old Faithful	49	15	47	7
Old Faithful to West Thumb	45	11	43	3
West Thumb to Flagg Ranch	44	10	42	2
Grassy Lake Road	42	2	41	0
Flagg Ranch to Colter Bay	44	10	42	2
Colter Bay to Moran Junction	40	7	38	0
Moran Junction to East Entrance	47	13	45	5
Moran Junction to South Entrance	46	14	44	6
Teton Park Road	No Vehicles	No Vehicles	No Vehicles	No Vehicles
Moose-Wilson Road	24	0	22	0
Jackson Lake	No Vehicles	No Vehicles	No Vehicles	No Vehicles

Table 91 shows that the hourly L_{eq} values at 100 feet are highest for the West Entrance-Madison, Madison-Old Faithful and West Thumb-Flagg Ranch segments. Average sound levels at 100 ft are 5 to 10 dB higher in alternative 2 than in alternatives 1a and 1b. This result is due to the presence of a greater number of total vehicles, including snowmobiles.

Table 91. Average Hourly L_{eq} from Vehicular Noise at Two Distances from Each Road Segment: Alternative 2.

Road segment	Leq at distance (dBA)			
	Open terrain		Forested terrain	
	100 ft	4000 ft	100 ft	4000 ft
Mammoth to Northeast Entrance	35	2	33	0
Mammoth to Norris	48	9	47	1
West Entrance to Madison	55	16	53	8
Madison to Norris	54	14	52	6
Norris to Canyon Village	53	13	51	5
Canyon Village to Fishing Bridge	52	12	50	4
Fishing Bridge to East Entrance	52	11	50	3
Fishing Bridge to West Thumb	51	11	50	3
Madison to Old Faithful	56	16	54	8
Old Faithful to West Thumb	53	13	52	5
West Thumb to Flagg Ranch	55	15	53	7
Grassy Lake Road	46	5	44	0
Flagg Ranch to Colter Bay	50	10	48	2

Road segment	Leq at distance (dBA)			
	Open terrain		Forested terrain	
	100 ft	4000 ft	100 ft	4000 ft
Colter Bay to Moran Junction	50	11	48	3
Moran Junction to East Entrance	51	14	49	6
Moran Junction to South Entrance	46	13	44	5
Teton Park Road	No Vehicles	No Vehicles	No Vehicles	No Vehicles
Moose-Wilson Road	24	0	22	0
Jackson Lake	46	4	44	0

Table 92 shows that the hourly L_{eq} values at 100 feet are highest for the West Entrance-Madison, Madison-Old Faithful and West Thumb-Flagg Ranch segments. Average sound levels at 100 ft are 5 to 10 dB higher in alternative 3 than in Alternatives 1a and 1b. This result is due to the presence of a greater number of total vehicles, including snowmobiles. Levels in alternative 3 are slightly lower than those in alternative 2, because the number of total vehicles on most segments is reduced.

Table 92. Average Hourly L_{eq} from Vehicular Noise at Two Distances from Each Road Segment: Alternative 3.

Road segment	Leq at distance (dBA)			
	Open terrain		Forested terrain	
	100 ft	4000 ft	100 ft	4000 ft
Mammoth to Northeast Entrance	35	2	33	0
Mammoth to Norris	48	9	47	1
West Entrance to Madison	54	16	52	8
Madison to Norris	53	13	51	5
Norris to Canyon Village	52	12	50	4
Canyon Village to Fishing Bridge	51	11	49	3
Fishing Bridge to East Entrance	49	8	47	0
Fishing Bridge to West Thumb	50	10	48	2
Madison to Old Faithful	55	17	54	9
Old Faithful to West Thumb	52	12	50	4
West Thumb to Flagg Ranch	54	14	53	6
Grassy Lake Road	49	8	47	0
Flagg Ranch to Colter Bay	49	8	47	0
Colter Bay to Moran Junction	48	11	47	3
Moran Junction to East Entrance	49	13	48	5
Moran Junction to South Entrance	46	13	44	5
Teton Park Road	No Vehicles	No Vehicles	No Vehicles	No Vehicles
Moose-Wilson Road	24	0	22	0
Jackson Lake	No Vehicles	No Vehicles	No Vehicles	No Vehicles

Definition of Impact Levels for Noise

Impacts on the natural soundscape are complex, as with many other resources and values. Complexity is a blend of the geographic source, frequency and magnitude of man-made

sound. The natural soundscape is an intrinsic resource or value of park lands, and includes all of the sounds of nature absent any sounds from human sources. Audibility (i.e., whether a sound can be heard at all within the natural soundscape), sound level (i.e., amount of sound energy or "loudness" of the sound), and time factors (i.e., duration, frequency of occurrence, and timing) of noise is interpreted as an impact on the natural soundscape. The definition of impact levels takes these factors into account. How the listener is affected qualitatively by noise is a relative concept not dealt with here, but rather under visitor experience.

Table 92. Definition of impacts to the natural soundscape

Impact Category	Definition
No Effect	An action that does not affect the natural soundscape or the potential for its enjoyment, and unique soundscape characteristics are not present.
Adverse Negligible Effect	An action that may affect the natural soundscape or potential for its enjoyment, but with infrequent occurrence and only for short duration at low sound levels. At this impact level, unique soundscape characteristics (such as bubbling hot springs or geysers are not affected.
Adverse Minor Effect	An action that may affect the natural soundscape or potential for its enjoyment in zones of use where man-made sounds are expected. In those zones, duration, frequency of occurrence, and level are all considered no more than minor. However, noise is rarely audible more than 50% of the time in these zones, and levels are rarely 50 dBA or greater at 100 feet or 10 dBA or greater at 4000 feet. Relatively few acres are affected in management zones where noise is not expected to be audible, and in those zones effects are infrequent with short duration and at low levels.
Adverse Moderate Effect	An action that may affect the natural soundscape or potential for its enjoyment in zones of use where man-made sounds are expected. In those zones, at least one of duration, frequency of occurrence, or level is considered moderate, but none are considered major. However, noise is audible 50% or more of the time in a minority of the area of these zones, and/or levels are often 50 dBA or greater at 100 feet or 10 dBA or greater at 4000 feet. A relatively disproportionate area is affected in management zones where noise is not expected to be audible, and/or in those zones effects are more than infrequent or of more than short duration or low level.
Adverse Major Effect	An action with an easily recognizable adverse effect on the natural soundscape or potential for its enjoyment. In zones where man-made sounds are expected, it is a major effect if any of the duration/frequency/levels are considered major, or if audibility is 50% or more of the time in half of these zones. A relatively disproportionate area is affected by noise in management zones where noise is not expected to be audible, or where any of duration/frequency/level in those zones is considered moderate or greater.

Conclusions

For perspective in a summary comparison of alternatives, the following information should be considered. A single snowmobile of a type evaluated in this SEIS (i.e., quietest available),

traveling at normal speed, is audible to a distance of 3,720 feet in open terrain with a quiet natural background. This is about one-third greater than the audibility distance affected by a single gas-powered "Mattrack" van snowcoach, which is audible to 2,200 feet under the same conditions. Because a snowcoach of this type would carry 4 to 6 times more visitors, visitation levels overall can be directly enhanced by a factor of 4 to 6 while reducing audibility distances by a third if snowmobiles were replaced by gasoline Mattracks one-for-one. In forested terrain, with a quiet background, the reduction is closer to one half than one third (2,030 to 1,210 feet). Presented another way, in a quiet background, a group of 8 to 12 snowmobiles is audible from 9,210 to 11,150 feet in open terrain, compared to a gas Mattrack carrying the equivalent number of people being audible to 2,200 feet. This replacement would reduce the audibility distance by a factor of 4 to 5 times. These mixes and tradeoffs are evident in the effects of the range of alternatives evaluated in this SEIS (see Chapter IV, Table 78 for information on the comparisons in this paragraph).

Table 93 presents a summary of the total acres of affected parkland for each project alternative. In the “audible at all” category, alternatives 1a and 1b affect the greatest acreage. This result is due the presence of the Bombardier snowcoach in the alternative 1a and 1b vehicle mix; that vehicle produces a low-frequency tone that can be heard for long distances. It should be noted that in these alternatives, only Bombardiers that can meet a 70dB sound level standard would be allowed. In the other two categories where audible percentages are shown, alternatives 1a and 1b affect significantly less acreage than either alternative 2 or 3. This result is due to the substantially reduced total number of vehicles present on park roadways.

Table 93. Acres of Affected Park Land, including impacts of wheeled vehicles.

Audibility metric	Background condition	Acres of affected park land, by project alternative		
		1a and 1b	2	3
Audible at all	Average	178,445	165,711	160,758
	Quiet	199,062	182,544	175,705
Audible 10% of the time or more	Average	74,795	110,490	102,033
	Quiet	95,060	124,773	115,034
Audible 50% of the time or more	Average	12,916	43,996	30,070
	Quiet	14,087	53,087	36,265

Again, as explained above, some of the acreage in Table 93 is due to wheeled vehicles on plowed roads which do not change in any of the SEIS alternatives. If the wheeled vehicles are removed, the acreages decrease, most dramatically in the 50% or more category where

the greatest impacts occur. This more accurately represents the effects of the alternatives being considered. The acreage on which sound is audible more than 50% of the time is 18 times greater in alternative 2 than in alternatives 1a and 1b, and almost 11 times greater in alternative 3.

Table 94. Acres of affected park land, considering only oversnow vehicles.

Audibility metric	Background condition	Acres of affected park land, by project alternative		
		1 and 2	3	4
Audible at all	Average	156,731	143,997	139,044
	Quiet	175,220	158,702	151,863
Audible 10% of the time or more	Average	60,259	95,954	87,497
	Quiet	78,138	107,851	98,112
Audible 50% of the time or more	Average	1,793	32,873	18,947
	Quiet	2,262	41,262	24,440

In alternatives 1a and 1b, the average hourly sound levels at 100 feet from the travelway are highest for the West Entrance-Madison and Madison-Old Faithful segments. Overall, the average sound levels are significantly lower for alternatives 1a and 1b (5 to 10 dB) at 100 ft as compared to alternatives 2 and 3 for the YNP road segments where the snowmobiles would be replaced with snowcoaches. At 4,000 feet away, the average sound level values are also highest for the West Entrance-Madison and Madison-Old Faithful segments, as well as the segments from Moran Junction to both the East Entrance and the South Entrance of GTNP.

For alternative 2, the average hourly sound levels at 100 feet from the travelway are highest for the West Entrance-Madison, Madison-Old Faithful, and West Thumb-Flagg Ranch segments. Average sound levels at 100 ft are 5 to 10 dB higher in alternative 2 than in alternatives 1a and 1b. This result is due to the presence of a greater number of total vehicles, including snowmobiles.

For alternative 3, the average hourly sound levels at 100 feet from the travelway are highest for the West Entrance-Madison, Madison-Old Faithful and West Thumb-Flagg Ranch segments. Average sound levels at 100 ft are 5 to 10 dB higher in alternative 3 than in alternatives 1a or 1b. This result is due to the presence of a greater number of total vehicles, including snowmobiles. Levels in alternative 3 are slightly lower than those in alternative 2, because the number of total vehicles on most segments is reduced.

Considering park-wide impacts, all alternatives affect substantial acres outside the travel corridors in terms of where noise is audible at all. Therefore, all alternatives have the

potential for adverse and moderate impacts. In reviewing the acres by alternative in which noise is audible 10% or more of the time, all alternatives have a disproportionate number of backcountry[8] or nonmotorized zone acres affected by sound generated in the travelways. However, acres affected in alternatives 2 and 3 are substantially higher than in alternatives 1a and 1b. The numbers of road segments (and associated areas) in which it could be stated there are adverse moderate impacts on sound are higher in alternatives 2 and 3. In alternatives 1a and 1b, the number of acres where noise is audible greater than 50% of the time is less than the number of acres located in zones where noise is produced (about 10,000 acres for all three park units)[9]. Alternative 2 exceeds this amount by 3 to 4 times the number of acres, and alternative 3 exceeds them by about 2 to 2.5 times as many. By this measure, alternatives 1a and 1b have the least impact on areas in which no noise is expected, thereby affecting the natural soundscape the least by a substantial margin. Alternatives 1a and 1b would have adverse minor impacts, particularly if aging and loud snowcoaches were to be replaced by quieter vehicles.

Alternative 2 would have the potential for moderate adverse impacts on the greatest number of road segments or areas, and potential for major adverse impacts on some segments and in nonmotorized zones where noise is not expected to be audible, loud or frequent. Alternative 3 would have fewer segments and zones affected at this level, while eliminating a moderate adverse impact in the area of Jackson Lake.

THE EFFECTS OF IMPLEMENTING THE ALTERNATIVES ON VISITOR ACCESS AND CIRCULATION

Impacts of a range of alternatives on visitor access and circulation are disclosed in the FEIS. This analysis therefore tiers to the analysis presented in the FEIS. All alternatives in the FEIS provide for access at current levels of visitation, although the alternatives provided different mixes of use redistribution and mode of access. It is no different for the SEIS alternatives. Each alternative provides, as a minimum, for current levels of visitation. Alternatives 1a and 1b provide this visitation by use of snowcoaches throughout all areas that are currently accessible by oversnow motorized means in and to YNP. Alternative 2

[8] "Backcountry" is a reference to portions of the park that are generally outside the travel corridors. In terms of the alternatives in this SEIS, backcountry is defined in the management zone tables as Zone 8.

[9] This value is calculated to provide a context for the magnitude of impact associated with motorized oversnow transport, and the area over which the total sound impact is audible by alternative. It is calculated by adding the total length of oversnow route in this analysis (including routes that are co-located with wheeled vehicle traffic) times the width of the corridor, and converting the area to acres [218 mi x 5280 ft/mi x 300 ft x 1/43560 ac/ft^2 = approx 8000 ac]. Most corridors border recommended or proposed wilderness, defined as being 100 ft from either side of the road. The same convention is used to relate corridors to backcountry.

provides for access at or above current levels of visitation by snowmobiles, in addition to the present level of snowcoach use, in all areas presently available for oversnow motorized use. Alternative 3 provides for access in most park areas, at current use levels, by snowmobile. It also provides for additional use by snowcoach at or above current levels of visitation in all areas presently served by snowcoach. In the 3-park area, these alternatives have no impact on the opportunity for motorized access, or the areas in which people use motorized access to circulate and enjoy park resources and values. The mode of access is a function of visitor preference for a certain type of travel experience, unrelated to the intrinsic values of the parks. Therefore, the impacts of each alternative regarding changes in access mode are dealt with under visitor experience. Under NPS policies, visitor experience is more associated with the quality of resources and values in the park setting, and less associated with the mode of transport used to access them.

THE EFFECTS OF THE IMPLEMENTING THE ALTERNATIVES ON VISITOR EXPERIENCE

Methods and Assumptions

Analyses of impacts on the visitor experience are limited to alternative features that pertain to oversnow motorized access in the parks and groomed roads and trails for motorized use. The analysis is further limited to those key indicators of visitor experience for which new information and analysis may alter the assessment of impacts as disclosed in the FEIS and for which impacts may vary by alternative (see impact topics addressed in Chapter III). The analysis of impacts on visitor experience discussed in the FEIS remains valid: see Chapter IV, *Effects of Implementing the Alternatives on Visitor Experience*.

This assessment is based on visitor surveys of several different groups of respondents. The first group includes data from surveys of winter visitors to the parks. The second group includes surveys that examine the opinions of summer visitors and the local, regional and national populations at large concerning winter use management. The third set of surveys includes information from studies conducted by the states of Montana, Idaho and Wyoming, and Teton County, Wyoming. Two indicators of impact level were used in the analysis. First, the availability of the range of winter visitor opportunities was determined for each alternative. Second, the range of opportunities available under each alternative was compared with the satisfaction, importance and value that the various survey respondents place on that particular experience or opportunity. Where the opinions of different user groups diverge concerning a particular value, they are identified in the analysis.

Criteria that are used to gage visitor satisfaction in each alternative are:

- Opportunities for viewing wildlife;
- Opportunities for viewing scenery;
- The quality of the groomed snow surface;
- Safety (the safe behavior of others);
- Access to winter activities and experience;
- Opportunities for quiet and solitude; and
- Clean air.

These indicators of visitor satisfaction were derived from eight primary sources: Littlejohn (1996); Friemund (1996); Borrie and Friemund (1997); Borrie et al. (1999); Davenport (1999); and Duffield et al. (2000a. 2000b, and 2000c) and the Wyoming Snowmobile Survey (2001). Other winter use surveys and assessments from Teton County, Wyoming, the states of Wyoming, Montana and Idaho, and the parks were used to validate the criteria. See Chapter III, *Visitor Experience*, for more detailed discussion of the survey data used in this analysis. Table 95 includes definitions for impacts to visitor experience.

Table 95. Definition of impacts to visitor experience.

Impact Category	Definition
Negligible	Little noticeable change in visitor experience.
Minor	Changes desired experiences but without appreciably limiting or enhancing critical characteristics of the experience.
Moderate	Changes critical characteristics of the desired experience or reduces or increases the number of participants.
Major	Eliminates, detracts from or greatly enhances multiple critical characteristics of the desired experience or greatly reduces or increases participation.
Neutral	An action that will create no change in the defined indicators of visitor satisfaction or quality of park experience.

Regulations and policies for management of visitor activities underlie the analysis determinations presented in the consequence discussions. Section 8.2 Visitor Use from the *National Park Service Management Policies 2001* provides specific direction.

8.2 Visitor Use

Enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks. The Service is committed to providing appropriate, high quality opportunities for visitors to enjoy the parks, and will maintain within the parks an atmosphere that is open, inviting, and

accessible to every segment of American society. However, many forms of recreation enjoyed by the public do not require a national park setting, and are more appropriate to other venues. The Service will therefore:

- Provide opportunities for forms of enjoyment that are uniquely suited and appropriate to the superlative natural and cultural resources found in the parks.
- Defer to local, state, and other federal agencies; private industry; and non-governmental organizations to meet the broader spectrum of recreational needs and demands.
- To provide for enjoyment of the parks, the National Park Service will encourage visitor activities that:
- Are appropriate to the purpose for which the park was established; and are inspirational, educational, or healthful, and otherwise appropriate to the park environment; and
- Will foster an understanding of, and appreciation for, park resources and values, or will promote enjoyment through a direct association with, interaction with, or relation to park resources; and
- Can be sustained without causing unacceptable impacts to park resources or values.

The primary means by which the Service will actively foster and provide activities that meet these criteria will be through its interpretive and educational programs, which are described in detail in chapter 7. The Service will also welcome the efforts of private-sector organizations to provide structured activities that meet these criteria. In addition to structured activities, the Service will, to the extent practicable, afford visitors ample opportunity for inspiration, appreciation, and enjoyment through their own personalized experiences, without the formality of program or structure. The Service will allow other visitor uses that do not meet all the above criteria if they are appropriate to the purpose for which the park was established and they can be sustained without causing unacceptable impacts to park resources or values.

Unless mandated by statute, the Service will not allow visitors to conduct activities that:

- Would impair park resources or values;
- Create an unsafe or unhealthful environment for other visitors or employees;
- Are contrary to the purposes for which the park was established; or

Unreasonably interfere with:

- The atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park;
- NPS interpretive, visitor service, administrative, or other activities;
- NPS concessioner or contractor operations or services; or
- Other existing, appropriate park uses.

The Effects on Visitor Experience Common to All Alternatives

Visitors who have physical disabilities would have improved access under all alternatives as winter access action plans are implemented and barriers to facilities and programs are removed. All facilities, such as warming huts, mass transit or snowmobile staging areas and restrooms, proposed for construction or reconstruction, would comply with all federal and NPS accessibility requirements.

The Effects of Implementing Alternative 1a on Visitor Experience in YNP

The amount and type of winter visitor opportunities offered in the parks under alternative 1a, no action, are provided in Table 95.

Table 95. YNP visitor opportunities available under alternatives 1a and 1b.

Opportunity	Miles or Areas	Length of Season	Other
Oversnow motorized route — snowcoach	184	Mid-December to Mid-March	Late night closure 9 PM to 8 AM
Oversnow motorized trail	0	Mid-December to Mid-March	Late night closure 9 PM to 8 AM
Plowed route	76	Mid-December to Mid-March	

Visitor Satisfaction and Experience in YNP

Opportunities to view wildlife. Most winter visitors rate wildlife viewing as a primary or important reason for visiting the parks. Most visitors are generally satisfied with the amount of wildlife viewing opportunities currently available. One of the top three reasons for visiting YNP cited by Borrie et al. (1999) was to view bison.

Opportunities to view wildlife would not decrease under this alternative because all oversnow routes would remain open and no limits on visitor access would be implemented. Because snowcoach travelers are free to watch for wildlife, the quality and quantity of viewing opportunities may increase for these visitors. However, because visitors riding on snowcoaches travel in groups, wildlife viewing would rarely be a solitary or an individualized experience and visitors would not experience the personal freedom to stop and view wildlife at will.[10]

Opportunities to view scenery. Most winter visitors to YNP and GTNP (Littlejohn 1996; Borrie et al. 1999) rate viewing scenery as a primary reason for their visit. Recent visitors to YNP indicated that they were for the most part "totally" satisfied with the quality of scenery in the parks.

Opportunities to view scenery would not decrease under this alternative because all oversnow routes would remain open and no limits on visitor access would be implemented. However, the nature of the viewing experience for motorized access would change substantially. Visitors who find the personal freedom to stop and view scenery, at will, essential to their park experience would be adversely affected by this alternative (see below discussion on the *Availability of Access to Winter Activities*).

[10] It is important to note that impromptu stops by snowcoaches to view scenery and wildlife are frequent occurrences under current operations and there is no reason to assume that this situation would change.

Safety (the safe behavior of others). Snowmobile riders and skiers rate this factor as important and indicate that it has an influence on the enjoyment of their visit. Many visitors indicate that the dual use of trails and areas for both snowmobiling and skiing contributes to the perception of an unsafe environment.

Snowcoach-only travel would eliminate the risk of snowmobile accidents and snowmobile/skier conflicts. The general decrease in vehicle miles traveled would necessarily reduce the likelihood of motorized vehicle accidents. In addition, there were no large mammals hit or killed by busses or snowcoaches in YNP from 1989 to 1998 (Gunther et al. 1998). Wildlife and snowmobile collisions often result in human injury. Alternative 1a would result in moderate to major beneficial improvements to visitor safety.

Quality of the groomed surface. More than 80% of winter visitors rate the quality of the groomed road surface as very important. The groomed surface from West Entrance to Old Faithful is frequently very rough and the quality of snow cover is poor.

Both positive and negative effects to the groomed surface would occur under this alternative. The larger tracks of snowcoaches would reduce the overall quality of the groomed surface. However, because the total number of vehicles would be reduced, an net improvement in groomed surface quality would be expected.

The availability of access to winter activities or experiences. Nearly all respondents to a recent survey (Borrie et al. 1999) supported oversnow mechanized access. More than 90% of winter visitors surveyed did not support plowed roads and snowcoach-only travel. Most winter visitors valued highly the winter experience in the parks and felt it was a special and unique experience. Winter respondents to the 1998-1999 winter visitor survey (Duffield et al. 2000a) also favored access to the parks by snowmobile. Respondents to the summer (Duffield et al. 2000b) and telephone surveys (Duffield et al. 2000c) were more evenly divided between support for groomed roads for snowmobiles and support for groomed access for snowcoaches. Plowed access also received very low support from the summer and telephone survey respondents. Similarly, in a count of public comments supporting various alternatives in the DEIS, there was an even split between numbers of letters supporting groomed access for snowmobiles (44%) and those supporting groomed access for snowcoaches only (45%). Comment letters on the FEIS were less evenly divided. Of the 10,880 letters received, 70% supported the elimination of snowmobiles from the parks.

Oversnow mechanized access would be maintained on all existing groomed routes. Snowcoaches generally travel at lower speeds (about 30 mph to 35 mph) than snowmobiles (40 mph to 45 mph). For visitors who travel from the South Entrance to Old Faithful the slower snowcoach travel time combined with the additional oversnow mileage from Colter Bay would require an additional one hour of travel time each way.

The removal of snowmobile access into the park would eliminate the current most popular form of winter experience (more than 60% of users) resulting in major adverse effects on snowmobile users.[11]

The late night closure from 9 P.M. to 8 A.M. would result in minor adverse effects due primarily to visitor inconvenience.

Availability of information. Surveyed winter visitors indicate that the availability of safety information is very important. Accurate and readily available information about safe travel practices and winter conditions is one of the suggested management actions that received a high level of support from most respondents.

Additional visitor contact stations, warming huts and an aggressive information program would enhance visitor safety and understanding of the winter environment under this alternative.

Quiet and solitude. Most survey respondents felt that natural quiet and solitude was important to the quality of their park visit. A recent study indicates that respondents ranked experiencing tranquility, peace, quiet, and getting away from crowds as highly important (Borrie et al. 1999).

Under alternative 1a only snowcoaches that can meet strict sound standards would be allowed in the parks. Initially, reduction in sound emissions would be moderate. However, as bombardier snowcoaches, which produce higher sound levels, are retrofitted or phased out the opportunities to experience quiet would be greatly improved. Average noise levels would not exceed 50 dB at 100' on any road segment. Average noise levels would exceed 10 dB over 4000' on approximately 7 road segments. This alternative would result in major beneficial effects over time, particularly for nonmotorized users of the parks. Because of the

[11] Recent survey data collected by Duffield et al. (2000a) indicates that about 33.4% of nonresident winter visitors would not return to YNP under snowcoach-only management. However, national and regional survey respondents indicated that they favored snowcoach-only access (Duffield et al. 2000c). Similarly, a review of public comment on the DEIS indicates an even split between those who favored snowmobile access and those who favored snowcoach only access. For park visitors who favored snowcoach only access, alternative 1a would have a positive effect.

mass transit requirements, options for solitude would be limited for visitors who cannot physically ski or hike.

Motor vehicles in this alternative would be audible over 14,090 acres for greater than 50% of the time. Travel corridors encompass approximately 10,000 acres (see *Effects of Implementing the Alternatives on the Natural Soundscape*). Vehicle noise would therefore result in moderate beneficial improvements in opportunities to experience quiet in the backcountry when compared to alternative A in the FEIS.

Clean Air. Clean air was important to most visitors (Littlejohn 1996). Surveyed visitors indicated a high level of support for management actions requiring clean and quiet snowmobiles (Duffield et al. 2000c; Borrie et al. 1999; Wyoming 2001). Through the permitting process the NPS would require that all snowcoaches meet the highest environmental standards possible for commercially produced mass transit oversnow vehicles. Currently this vehicle is the mat track conversion van. The reductions in vehicle emissions would provide major beneficial improvements in opportunities to experience clean air in YNP.

Conclusion

The reduction in emissions and sound under this alternative would result in direct major beneficial improvements to the experiences of park visitors. There would be a minor to moderate beneficial impact on visitor experience due to increased availability of information, interpretation, and winter programs. There would be no change relative to alternative A in opportunities to view wildlife and scenery. There would be major beneficial changes relating to safety by eliminating the possibility of snowmobile related motor vehicle accidents.

The elimination of snowmobiles would result in major adverse impacts to the experiences of visitors in this user group. Currently this represents 60% of all winter visitors to the park.

Under specific circumstances, the adaptive management provisions of this alternative may result in area closures. If monitoring or scientific studies regarding winter visitor use, natural resources, and other park values indicate that sections of the park must be closed or certain uses restricted to protect park values (for example, snowmobiling or backcountry skiing), some or all visitor experiences in the closure area would be eliminated. These areas of closure would result in localized direct adverse impacts to desired winter visitor

experience. However, the long term protection of these resources would provide major benefits to the protection of desired visitor experiences park-wide.

The Effects of Implementing Alternative 1a on Visitor Experience in Grand Teton and the Parkway

The amount and type of winter visitor opportunities offered in the parks under the no action alternative are provided in Table 96.

Table 96. GTNP and the Parkway visitor opportunities available under alternatives 1a and 1b.

Opportunities	Miles or Areas	Length of Season	Other
Groomed motorized route	0	December to April†	Late night closure 9 PM to 8 AM
Groomed motorized route, snowcoach	29	December to April†	Late night closure 9 PM to 8 AM
Groomed motorized trail	0	December to April†	Late night closure 9 PM to 8 AM
Plowed road	83.4	N/A	N/A
Ungroomed motorized trail or area	0	December to April†	Late night closure 9 PM to 8 AM

† Variable based on weather

Visitor Satisfaction and Experience in GTNP

Opportunities to view wildlife. Visitors on plowed roads, the CDST, and Jackson Lake would continue to enjoy wildlife and scenery viewing. Viewing opportunities would be eliminated for riders of snowmobiles on Jackson Lake and the CDST. This would result in major adverse effects on the experiences of these visitors.

Opportunities to view scenery. With the elimination of snowmobile access, and no wheeled vehicle access north of Colter Bay, there would be fewer opportunities to view scenery by auto and snowmobile. Scenery would be viewed in this area from a snowcoach operating from Colter Bay north to YNP and Flagg Ranch west to Idaho.

Safety (the safe behavior of others). The CDST would be eliminated through GTNP and the Parkway, except for mass transit from Colter Bay to YNP and the west Parkway boundary. This would enhance safety for other nonmotorized uses on these routes.

Quality of the groomed surface. Oversnow motorized uses would be eliminated except for snowcoaches. Snowcoaches would operate on a groomed route from Colter Bay into YNP

and to the west Parkway boundary on Grassy Lake Road. Because of the overall reduction in the number of vehicles traveling these routes, minor to moderate improvements to the groomed surface would be expected under this alternative.

The availability of access to winter activities or experiences. Access to motorized winter experiences would be decreased except for snowcoaches operating from Colter Bay into YNP and to the west Parkway boundary. There would be a loss of ice fishing opportunities via snowmachine on Jackson Lake. The closure of Jackson Lake to snowmobiles would result in major adverse effects on visitors who cannot ski or snowshoe to fishing areas. The exclusion of motorized travel from the lake would also result in limited access to Webb Canyon and other backcountry areas. However, nonmotorized use on and in the vicinity of the lake would be enhanced. Under this alternative, skiing on the groomed surface of the roadway north of Moran Junction would also be available. These actions would particularly benefit local residents who indicated that skiing in the park was their favorite activity (Teton Co. 1998). However, because of the elimination of wheeled access to Flagg Ranch after 2008, visitors who wish to ski in areas between Moran Junction and Flagg Ranch may (depending on distance) require a snowcoach shuttle for transport. The closure of the CDST would result in major adverse effects on visitors (approximately 2,017 annually) who wish to snowmobile on this route.

Availability of information. There would be enhanced and increased visitor programs, facilities, and interpretive opportunities to better meet the expectation and need for information.

Quiet and solitude. With elimination of snowmobile and snowplane use, opportunities for quiet and solitude would be enhanced. The major benefit of this would accrue to nonmotorized uses. There would be a lost opportunity for snowmobilers who are seeking this experience.

Clean air. With elimination of snowmobile use, a major source of pollution would be eliminated. The opportunity to experience clean air would be greatly enhanced under this alternative.

Conclusion

Negligible to minor adverse impacts on visitor experience relating to wildlife and scenery viewing would occur because of the elimination of motorized travel on the frozen surface of Jackson Lake. Opportunities to view wildlife would be improved for nonmotorized users of

these areas. There would be major beneficial changes relating to safety by eliminating the possibility of snowmobile-related motor vehicle accidents, and wheeled vehicle accidents on the road segment from Colter Bay to Flagg Ranch. Improving groomed surfaces would be moderately beneficial for snowcoach use and occupant safety. Overall, there would be a major adverse impact on the availability of access for those who wish to ride snowmobiles or snowplanes. There would be a minor to moderate beneficial impact to visitor experience due to increased availability of information, interpretation, and winter programs. There would be a major beneficial impact relative to opportunities for quiet and solitude. Opportunities to appreciate clean air would be greatly improved. Where oversnow motorized use occurs, via snowcoach, quiet and clean air would be facilitated by improved motorized technology.

The adaptive management provisions of this alternative require that if monitoring or scientific studies regarding winter visitor use, natural resources and other park values indicate that sections of the park must be closed or certain uses (for example, snowmobiling or backcountry skiing) restricted to protect these values, some or all visitor experiences currently afforded in the area of closure would be eliminated. These areas of closure or reductions in use would result in direct and localized adverse impacts to desired winter visitor experience. However, the long term protection of these resources would provide major benefits to the protection of desired visitor experiences park-wide.

The Effects of Implementing Alternative 1b on Visitor Experience in YNP and Grand Teton and the Parkway

The effects of alternative 1b on visitor experience are the same as those indicated for alternative 1a with one exception. Because the full implementation of this alternative would be delayed until the winter of 2004-2005 the effects on visitor experience that are described for alternative A in the FEIS (pages 268-270) would continue until that time.

Effects of Implementing Alternative 2 on Visitor Experience in YNP

The amount and type of winter visitor opportunities offered in the parks under alternative 2 are provided in Table 97.

Table 97. YNP visitor opportunities available under alternative 2.

Opportunity	Miles or Areas	Length of Season	Other
Oversnow motorized route	184	Mid-November to Late-March	8 PM to 7:30 AM 8:30 AM from West Entrance
Oversnow motorized trail	0	Mid-November to Late-March	8 PM to 7:30 AM
Plowed route	76	N/A	N/A

Visitor Satisfaction and Experience in YNP

Opportunities to view wildlife. Upon full implementation of this alternative, the opportunity to view wildlife would not decrease because the all major oversnow routes would remain open to motorized travel. However, on high use days, wildlife viewing would rarely be a solitary experience.

Opportunities to view scenery. Opportunities to view scenery would not decrease under this alternative because all oversnow routes would remain open to motorized travel.

Safety (the safe behavior of others). Snowmobile riders and skiers rate this factor as important and indicate that it has an influence on the enjoyment of their visit. The effects on safety under this alternative would be similar to those described in alternative A of the FEIS with one exception. The decreased speed limit on the West Entrance road would result in improvements in safety for park visitors.

Quality of the groomed surface. More than 80% of winter visitors rate the quality of the road surface as very important. The groomed surface from West Entrance to Old Faithful is frequently very rough and the quality of snow cover is poor. Adaptive management provisions for this alternative indicate that for Zone 3 (groomed motorized routes) that groomed surfaces must remain no worse than "fair" for 35% of a 24 hour period (approximately 8.4 hours). If this standard is exceeded management actions include increased grooming and an adjustment of vehicle numbers when threshold temperature is reached.

The availability of access to winter activities or experiences. The ability to snowmobile into the park at current use levels would maintain the current most popular form of winter experience (more than 60% of users) resulting in major beneficial effects on those users. The adaptive management provisions of this alternative propose preliminary management actions that would be implemented if some resource or experience thresholds were exceeded.

Management actions for sound, smoothness of groomed surfaces, and visitor satisfaction include adjusting visitor numbers. If mitigation is unsuccessful, visitor numbers could be reduced (if successful numbers could be increased). These reductions would result in direct and localized adverse impacts to desired winter visitor experience. However, the long term protection of these resources would provide major benefits to the protection of desired visitor experiences park-wide.

Under alternative 2, use limits would be implemented beginning in 2002-2003. In the first year total snowmobile use in YNP would be limited to 1,700 per day. In the second year, snowmobile use would be limited to 1,500 per day and in year three forward, use would be limited to 1,300 snowmobiles. Although these use limits would accommodate most visitors who wish to snowmobile, on some peak demand days, some visitors may be displaced. The nine year average daily use (1992 through 2001) through the West Entrance is about 570 snowmobiles. On a peak or high use day, approximately 1,000 to 1,200 snowmobiles enter YNP through the West Entrance. Beginning in 2004-2005, alternative 2 requires an interim daily use limit of 500 snowmobiles from the West Entrance. On an average use day this alternative would result in moderate to major adverse effects on the 70 to 100 snowmobile riders who would be displaced from that opportunity daily.[12] Visitors who wish to enter through the other three YNP entrances would not be affected because the proposed interim use limits at those gates exceed historic peak use numbers. The most restrictive use limit under alternative 2 would limit snowmobile use to 1,300 per day. Using an average winter season of 82 days this alternative could accommodate 106,600 snowmobiles. The average number of snowmobile *passengers* that enter the park annually is 80,315. This alternative would more than accommodate peak years such as 1993 when 91,196 snowmobile passengers entered the park.

Overall the proposed use limits would result in minor adverse effects on snowmobile enthusiasts. Because use limits at other entrances exceed historic use numbers access would be available if a reservation system were implemented. Areas of the park that have not previously experienced high levels of snowmobile use may experience an increase in snowmobile use.

The late night closure from 8 P.M. to 7:30 A.M. (8:30 AM from the West Entrance) would result in moderate adverse effects due primarily to visitor inconvenience. Nighttime closures

[12] This analysis makes no assumption that displaced snowmobile riders would choose to ride a snowcoach instead and makes no assumptions about the double passengers on snowmobiles.

would eliminate the opportunity for some visitors to dine at Snow Lodge or the Mammoth Hotel in the evening and then access lodging outside or inside the park respectively. The late morning opening would result in a reduction of vehicles operating during the early morning hours. This action would result in negligible to minor beneficial improvements in opportunities to ski or snowshoe near Old Faithful without the smell and sound of snowmobiles.

Availability of information. Surveyed winter visitors indicate that the availability of safety information is very important. Accurate and readily available information about safe travel practices and winter conditions is one of the suggested management actions that received a high level of support from most respondents. The additional information and education programs proposed under this alternative would result in major beneficial effects for all visitors. Several of the implementation strategies under this alternative, particularly the "bison brigade" and increased ranger patrols would result in moderate improvements to the visitor experience.

Quiet and solitude. Most survey respondents felt that natural quiet and solitude was important to the quality of their park visit. Because of the requirements in this alternative for quieter snowmobiles, opportunities for quiet will increase. This alternative allows for a substantial increase in snowmobile use from the North and East entrances. Snowmobile users that currently enjoy entering the park from the West Entrance of YNP may be displaced to other areas of the parks. This displaced use would adversely effect the ability of some visitors to find solitude in the park.

This alternative would result in an average noise level that exceeds 50 dB over 100 feet from the road for 172 miles of groomed road and exceeds 10 dB over 4000 feet on 13 road segments. This is a minor increase over alternative A in the FEIS, and a moderate to major increase over alternatives 1a and 1b in this SEIS. Although technology would improve, there would be little reduction in overall vehicle numbers in this alternative.

Motor vehicles in this alternative would be audible over 53,090 acres for greater than 50% of the time. Travel corridors encompass approximately 10,000 acres. Vehicle noise in this alternative would therefore result in moderate adverse effects on backcountry users when compared to alternative A in the FEIS.

Clean Air. Clean air was important to most visitors (Littlejohn 1996). Surveyed visitors indicated a moderate to high level of support for management actions requiring clean and quiet snowmobiles (Duffield et al. 2000c; Borrie et al. 1999; Wyoming 2001).

Under alternative 2 snowmobiles would be required to meet emissions requirements. Although this alternative decreases snowmobile use through the West Entrance it also allows for a substantial increase in snowmobile use from other park entrances. Cleaner snowmobile emission requirements and prepaid passes specified under this alternative would result in a minor to moderate increase in opportunities to experience clean air when compared to alternative A in the FEIS, due to improvements in snowmobile technology. This alternative would result in a moderate to major decrease in opportunities to experience clean air near the West Entrance and Old Faithful when compared to alternatives 1a and 1b. Although technology would improve, there would be little reduction in overall vehicle numbers under this alternative.

Conclusion

Snowmobile users would experience little change in opportunities to view wildlife and scenery from alternative A as described in the FEIS. However, the quality of those experiences would be moderately and adversely affected for some visitors, particularly on peak use days. There would be few changes in the effects relating to safety from alternative A. There would be a minor to moderate beneficial impact to visitor experience due to increased availability of information, interpretation, and winter programs. There would be minor improvements relative to opportunities for quiet and solitude. Opportunities to appreciate clean air would be increased from alternative A providing a minor to moderate beneficial effect. Where oversnow motorized use occurs quiet and clean air would be facilitated by improved motorized technology.

The adaptive management provisions of this alternative require that if monitoring or scientific studies regarding winter visitor use, natural resources and other park values indicate that resource or experience thresholds are exceeded management actions will be implemented to mitigate the effects. If mitigation is unsuccessful visitor numbers could be reduced. These reductions would result in direct and localized adverse impacts to desired winter visitor experience. However, the long-term protection of these resources would provide moderate benefits to the protection of desired visitor experiences park-wide.

The Effects of Implementing Alternative 2 on Visitor Experience in Grand Teton and the Parkway

The amount and type of winter visitor opportunities offered in GTNP and the Parkway under alternative 2 are provided in Table 98.

Table 98. GTNP and the Parkway visitor opportunities available under alternative 2.

Opportunities	Miles or Areas	Length of Season	Other
Groomed motorized route	2.1	December to April†	8:00 PM to 7:30 AM
Groomed motorized route, snowcoach	0	December to April†	8:00 PM to 7:30 AM
Groomed motorized trail	34	December to April†	8:00 PM to 7:30 AM
Plowed road	100.1	N/A	
Ungroomed motorized trail or area	Jackson Lake	December to April†	8:00 PM to 7:30 AM

† Variable based on weather

Visitor Satisfaction and Experience in GTNP

Opportunities to view wildlife and scenery. Visitors on plowed roads, the CDST and fishermen on Jackson Lake would continue to enjoy wildlife and scenery viewing.

Safety (the safe behavior of others). Visitors would continue to perceive unsafe conditions along the CDST. There would be moderate adverse effects relating to safety by continuing the possibility of snowmobile-related motor vehicle accidents, and wheeled-vehicle accidents on the road segment from Moran Junction to Flagg Ranch. These safety concerns would increase as use of the CDST increases.

Quality of the groomed surface. The quality of groomed surfaces in this alternative would be similar to those described under alternative A in the FEIS on page 269.

The availability of access to winter activities or experiences. Visitors who enjoy snowmobiling would experience major beneficial effects for the majority of the winter season. Use limits proposed under this alternative for the CDST and Grassy Lake Road exceed historic peak daily use. There would be no adverse effects on snowmobile riders under this alternative.

Availability of information. There would be enhanced and increased visitor programs facilities and interpretive opportunities to better meet the expectation and need for information.

Quiet and solitude. See YNP alternative 2. Because of continued snowmobile use on Jackson Lake backcountry nonmotorized users would continue to experience moderate adverse effects on opportunities to experience quiet and solitude.

Clean air. See YNP alternative 2.

Conclusion

Negligible to minor adverse impacts on visitor experience relating to wildlife and scenery viewing would occur because of the elimination of motorized travel on the frozen surface of Jackson Lake. Anglers who use snowmobiles, however, would not be affected. There would be moderate improvements to safety by eliminating the possibility of snowmobile-related motor vehicle accidents, and wheeled-vehicle accidents on the road segment from Moran Junction to Flagg Ranch. There would be a minor to moderate beneficial impact to visitor experience due to increased availability of information, interpretation, and winter programs. There would be a minor improvement relative to opportunities for quiet and solitude and minor to moderate improvements in opportunities to appreciate clean air. Where oversnow motorized use occurs, quiet and clean air would be facilitated by improved motorized technology, however the number of oversnow vehicles would be increased.

The adaptive management provisions of this alternative require that if monitoring or scientific studies regarding winter visitor use, natural resources and other park values indicate that resource or experience thresholds are exceeded management actions will be implemented to mitigate the effects. If mitigation is unsuccessful visitor numbers could be reduced. These reductions would result in direct and localized adverse impacts to desired winter visitor experience. However, the long term protection of these resources would provide some moderate benefits to the protection of desired visitor experiences park-wide.

The Effects of Implementing Alternative 3 on Visitor Experience in YNP

The amount and type of winter visitor opportunities offered in YNP under alternative 3 are provided in Table 99.

Table 99. YNP visitor opportunities available under alternative 3.

Opportunity	Miles or Areas	Length of Season	Other
Oversnow motorized route	176	Late November to Mid-March	Late night closure 9 PM to 8 AM

Opportunity	Miles or Areas	Length of Season	Other
Oversnow motorized route — snowcoach only	14	Late November to Mid-March	Late night closure 9 PM to 8 AM
Oversnow motorized trail	0	Late November to Mid-March	Late night closure 9 PM to 8 AM
Plowed route	76	N/A	

Visitor Satisfaction and Experience in YNP

Opportunities to view wildlife: Because all oversnow routes would remain open to motorized travel opportunities to view wildlife would not be limited. However, because visitors riding snowmobiles and snowcoaches would be accompanied by a guide, wildlife viewing would rarely be a solitary experience.

Because guides are generally well informed on proper behavior when approaching and viewing wildlife, requiring all visitors to travel with a guide would improve the quality of the viewing experience. Guides would also be familiar with the movements and locations of various wildlife species and may improve wildlife viewing opportunities for visitors.

Opportunities to view scenery. Opportunities to view scenery would not decrease under this alternative because all oversnow routes would remain open and accessible to visitors. Trained guides have a greater familiarity with the parks and would be able to direct visitors to areas of special interest.

Safety (the safe behavior of others). Under this alternative, all visitors would enter the park accompanied by a guide. The added education and enforcement of safe riding behavior would result in moderate beneficial improvements. A reduction in overall vehicle numbers would result in a decrease in the potential for accidents.

Quality of the groomed surface. Adaptive management provisions for this alternative indicate that for Zone 3, groomed motorized routes-that groomed surfaces must remain no worse than fair 20% for each daily period of operation (approximately 2.6 hours per day). If this standard is exceeded, management actions include increased grooming and an adjustment of vehicle numbers when threshold temperature is reached. This strategy in addition to a reduction of snowmobiles entering from the West Entrance will result in a moderate to major beneficial improvement in snow road conditions and visitor satisfaction.

The availability of access to winter activities or experiences. The ability to snowmobile into the park would maintain the current most popular form of winter experience (more than

60% of users) resulting in major beneficial effects on snowmobile users. The nine-year average daily use (1991 through 2001) through the West Entrance is 570 snowmobiles. On an average peak or high use day, approximately 1000 to 1200 snowmobiles enter YNP through the West Entrance. The interim daily use limit of 330 snowmobiles from the West Entrance would result in major adverse effects on the 200 to 300 snowmobile riders who would be displaced from that opportunity daily[13]. Visitors who wish to enter through the other three YNP entrances would not be affected because the proposed interim use limits at those gates exceed historic peak use numbers. Under alternative 3 parkwide snowmobile use would be limited to 930 snowmobiles per day. Using an average winter season of 82 days this alternative could accommodate 76,260 snowmobiles. The average number of snowmobile *passengers* that enter the park annually is 80,315. This alternative would also not accommodate peak years such as 1993 when 91,196 snowmobile passengers entered the park.

The late season closure to snowmobiles under this alternative would result in the displacement of potential 12,600 snowmobile riders. This closure would result in a major adverse effect on visitors seeking that recreational opportunity. However, the increase in the range of recreational opportunities would result in major beneficial improvements for visitors who prefer to recreate without the sound and smell of snowmobiles.

The adaptive management provisions of this alternative propose management actions that would be implemented if resource or experience thresholds were exceeded. Management actions for sound, smoothness of groomed surfaces and visitor satisfaction include adjusting visitor numbers.

The late night closures from 9 P.M. to 8 A.M. would result in moderate adverse effects due primarily to visitor inconvenience. Nighttime closures would eliminate opportunities for some visitors to dine at Snowlodge or the Mammoth Hotel in the evening and then access lodging outside the park.

Availability of information. The additional information and education programs proposed under this alternative would result in major beneficial effects for all visitors.

Quiet and solitude. Because of the requirement in this alternative for quieter snowmobiles opportunities for quiet would increase. This alternative allows for greater than historic peak

[13] This analysis makes no assumption on the number of snowmobile riders that may "ride double" if use limits are implemented.

use levels from the North, South and East entrances. Snowmobile users that currently enjoy entering the park from the West Entrance of YNP may be displaced to other areas of the parks. This displaced use would adversely effect the ability of some visitors to find solitude in the park.

This alternative would result in an average noise level that exceeds 50 dB over 100 feet from the road for 134 miles of groomed road and exceeds 10 dB over 4000 feet distant on 11 road segments. This is a negligible decrease over alternative A in the FEIS, and a moderate increase over alternatives 1a and 1b in this SEIS.

Motor vehicles in this alternative would be audible over 36,270 acres for greater than 50% of the time. Travel corridors encompass approximately 10,000 acres. Vehicle noise in this alternative would therefore result in minor adverse effects on backcountry users when compared to alternative A in the FEIS.

Clean Air. Under alternative 3, snowmobiles would be required to meet emissions requirements. Although this alternative decreases snowmobile use through the West Entrance it also allows for a substantial increase in snowmobile use from other park entrances. Cleaner snowmobile emission requirements, prepaid passes and a reduced number of vehicles would result in a moderate increase in opportunities to experience clean air when compared to alternative A in the FEIS. These alternative actions would result in a moderate decrease in opportunities to experience clean air near the West Entrance and Old Faithful when compared to alternatives 1a and 1b.

Conclusion

Snowmobile users would experience little change in opportunities to view wildlife and scenery from alternative A as described in the FEIS. However, there would be moderate and beneficial improvements in the quality of those experiences for some visitors. The use limit of 330 snowmobiles entering from the West would result in moderate to major adverse effects on approximately 300 snowmobile enthusiasts per day, particularly those who find entering from the West Entrance essential to their park experience. The use limit of 330 would result in moderate to major improvements to the groomed surface on that road segment. There would be moderate improvements to safety because of the emphasis on guided tours and snowcoaches under this alternative. There would be a minor to moderate beneficial impact to visitor experience due to increased availability of information, interpretation, and winter programs. There would be a moderate adverse effect relative to

opportunities for quiet and solitude when compared to alternatives 1a and 1b in this FEIS but moderate beneficial improvements in opportunities for quiet and solitude when compared to alternative A in the FEIS. Opportunities to appreciate clean air would be increased from alternative A and decreased when compared to alternatives 1a and 1b. Where oversnow motorized use occurs, quiet and clean air would be facilitated by improved motorized technology and reduced vehicle numbers.

The adaptive management provisions of this alternative require that if monitoring or scientific studies regarding winter visitor use, natural resources and other park values indicate that resource or experience thresholds are exceed management actions will be implemented to mitigate the effects. If mitigation is unsuccessful, visitor numbers could be reduced (if successful numbers could be increased). These reductions would result in direct and localized adverse impacts to desired winter visitor experience. However, the long term protection of these resources would provide major benefits to the protection of desired visitor experiences park-wide.

Effects of Implementing Alternative 3 on Visitor Experience — Grand Teton and the Parkway

The amount and type of winter visitor opportunities offered in GTNP and the Parkway under alternative 3 are provided in Table 100.

Table 100. GTNP and the Parkway visitor opportunities available under alternative 3.

Opportunities	Miles or Areas	Length of Season	Other
Groomed motorized route	2.1	December to April†	8:00 PM to 7:30 AM
Groomed motorized route, snowcoach	0	December to April†	8:00 PM to 7:30 AM
Groomed motorized trail	34	December to April†	8:00 PM to 7:30 AM
Plowed road	100.1	N/A	N/A

† Variable based on weather

Visitor Satisfaction and Experience in GTNP

Opportunities to view wildlife and scenery. Visitors on plowed roads, the CDST and Jackson Lake would continue to enjoy wildlife and scenery viewing. No viewing opportunities would be available for snowmobile riders to view wildlife or scenery on Jackson Lake.

Safety (the safe behavior of others). Visitors would continue to perceive unsafe conditions along the CDST. There would be moderate adverse effects relating to safety by continuing the possibility of snowmobile-related motor vehicle accidents, and wheeled-vehicle accidents on the road segment from Moran Junction to Flagg Ranch. These safety concerns would increase if use of the CDST increases.

Quality of the groomed surface. The results of this alternative would be similar to those described in alternative A as described in the on FEIS page 269.

The availability of access to winter activities or experiences. Visitors who enjoy snowmobiling would experience major beneficial effects for the majority of the winter season. Use limits proposed under this alternative for the CDST and Grassy Lake Road exceed historic use. There would be no adverse effects on snowmobile riders who use groomed routes under this alternative. The closure of Jackson Lake to snowmobiles would result in major adverse effects on visitors who cannot ski or snowshoe to fishing areas. The exclusion of motorized travel from the Lake would also result in limiting some access to Webb Canyon and other backcountry areas. However, nonmotorized use on the Lake would be enhanced

Availability of information. There would be enhanced and increased visitor programs facilities and interpretive opportunities to better meet the expectation and need for information.

Quiet and solitude. See YNP alternative 3. Because snowmobile use on Jackson Lake is eliminated, nonmotorized users in the backcountry would experience moderate to major beneficial effects primarily due to a reduction in sound levels.

Clean air. See YNP alternative 3.

Conclusion

Negligible to minor adverse impacts on visitor experience relating to wildlife and scenery viewing would occur because of the elimination of motorized travel on the frozen surface of Jackson Lake. There would be moderate adverse effects relating to safety by continuing the possibility of snowmobile-related motor vehicle accidents, and wheeled-vehicle accidents on the road segment from Moran Junction to Flagg Ranch. There would be minor to moderate beneficial effects on visitor experience due to increased availability of information, interpretation, and winter programs. There would be a minor to moderate beneficial effect relative to alternative A in the FEIS on opportunities for quiet and solitude and opportunities

to appreciate clean air. Where oversnow motorized use occurs, quiet and clean air would be facilitated by improved motorized technology.

The adaptive management provisions of this alternative require that if monitoring or scientific studies regarding winter visitor use, natural resources and other park values indicate that resource or experience thresholds are exceeded, management actions would be implemented to mitigate the effects. If mitigation is unsuccessful visitor numbers could be reduced. These reductions would result in direct and localized adverse impacts to desired winter visitor experience. However, the long term protection of these resources would provide major benefits to the protection of desired visitor experiences park-wide.

IMPAIRMENT OF PARK RESOURCES AND VALUES

A determination of whether or not, or to what degree each alternative in the SEIS would result in impairment will be deferred until the decision is made.

In managing units of the national park system, the Service may undertake actions that have both beneficial and adverse impacts on park resources and values. However, by the provisions of the laws governing the NPS, the Service is prohibited from taking or authorizing any action that would, or is likely to, impair park resources or values. In addition, under other environmental laws, adverse impacts may be prohibited as well. By Director's Order, impacts that may constitute an impairment of park resources or values are to be evaluated and described in impact analyses contained within environmental documents produced by the NPS.[14] Current NPS policy defining and providing direction on impairment issues is duplicated in the policy section of Chapter I (1.4.5 and 1.4.7).

Impairment is an impact that, in the professional judgement of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. Whether an impact meets this definition depends on the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts.

An impact to any park resource or value may constitute impairment. An impact would be more likely to constitute impairment to the extent that it affects a resource or value whose conservation is:

[14] Director's Order 12, January 8, 2001. Section 4.7

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- Identified as a goal in the park's general management plan or other relevant NPS planning documents.

An impact would be less likely to constitute an impairment to the extent that it is an unavoidable result, which cannot reasonably be further mitigated, of an action necessary to preserve or restore the integrity of park resources or values. Impairment may occur from visitor activities; NPS activities in the course of managing a park; or activities undertaken by concessioners, contractors, and others operating in the park.

The finding documented in the record of decision dated 11/22/00 was that, of the seven alternatives evaluated in the FEIS, only one did not exceed a level of impairment considered pursuant to NPS policy. This was the essential basis for selecting the alternative that eliminates snowmobile and snowplane use, as described in the rationale for the decision in the ROD. Alternative G in the FEIS, or the decision currently in place, was found not to result in impairment of park resources or values whose impacts are disclosed in the FEIS. In all other FEIS alternatives, current snowmobile use in YNP was found to impair air quality, wildlife, the natural soundscape, and opportunities for enjoyment of the park by visitors. In GTNP, impairment was found to result from snowmobile and snowplane use on the natural soundscape and opportunities for enjoyment of the park. In the Parkway, impairment was found to result from snowmobile use on air quality, the natural soundscape, and opportunities for enjoyment of the park. These findings were made for all alternatives with snowmobile use, including those that would have required phased-in use of cleaner and quieter snowmobiles in accordance with set objectives for emissions and sound. It was determined that there was no way to mitigate the impairment short of reducing the amount of use as determined by an effective carrying capacity analysis, or by imposing a suitable limit unsupported by such an analysis (ROD, pages 18-19).

DIRECT, INDIRECT AND CUMULATIVE IMPACTS ON ADJACENT LANDS

Possible impacts on adjacent lands resulting from each of the seven alternatives are disclosed in the FEIS on pages 434 through 474. The analysis in this SEIS is tiered to the FEIS and summarized here. There is no new information that would substantially alter the analysis of effects for the FEIS alternatives. The discussions below, summarized as they are, are adapted as possible to the SEIS alternatives.

Potential effects on lands within the GYA other than the three national park units is discussed in this section. The USFS; the States of Wyoming, Montana, and Idaho; and five counties surrounding the park units (all cooperating agencies in this EIS, see Chapter I and Appendix A of the FEIS) provided information for effects analysis in this section. Because the potential for impacts on adjacent lands (apart from economic impacts) is primarily due to possible displacement of winter recreation use from the parks, an analysis of displacement introduces the disclosure of possible impacts.

Possible Conflicts with other Land Use Plans, Policies or Controls

CEQ Regulations (40 CFR 1502.16(c)) require discussion of possible conflicts between the proposed action and objectives of land use plans, policies, or controls for the area concerned. The cooperating agencies represent the jurisdictions in which such conflicts might occur.

Counties. The chief concerns expressed by counties have to do with economic impacts of changes in park management (i.e., changes in access or mode of access, and recreational opportunities available from each gateway). Possible effects relating to loss of jobs or income in adjacent communities are disclosed in the *Socioeconomics* section, Chapter IV. Such impacts would not affect local government land use plans, other policies, or controls. This is largely because the essential objectives of park management have not changed, but the means by which they are to be attained could be altered. Teton County, Wyoming, expressed the desire that GTNP would be consistent with the county's new transportation plan. There is nothing in any winter use plan alternative that changes the transportation interface with the county. The park has initiated a separate environmental analysis to review year-round transportation needs in the park related to the county plan.

States. For the FEIS, the cooperating States did not indicate specific conflicts with any plan objectives. However, it can be assumed from their comments that existing snowmobile use does not violate any state or federal standards for air or water quality in or outside the parks. The State of Montana expressed concerns about displaced recreational use and its potential impacts in the areas of safety and wildlife management. These concerns are discussed in the Montana section below. It can be inferred that if significant use is displaced to state jurisdictional lands, some state objectives might not be met without further management. Wyoming's chief concerns had to do with possible declines in snowmobile tourism to the state through loss of recreational opportunities, and related economic effects. It can be inferred that this would conflict with state level tourism and recreation plan objectives. Similarly, Idaho was concerned about impacts of possible displacement on recreational

experience, groomed trail quality, and grooming expense – possibly conflicting with local plans and controls. The NPS has determined that there is no indication of any possible conflict with county land use plans for any alternative because land allocations and basic objectives in the parks would not change significantly. There is no new information from cooperating states that alters this assessment.

National Forests. All adjoining national forests have forest plans in effect. The Winter Visitor Use Management Assessment (GYCC 1999) identified conflicts relating to winter use. Most conflicts include motorized use and related infrastructure needs, wildlife impacts, and displacement of nonmotorized uses. The assessment indicates that most such conflicts can be handled within the framework of current forest plans, and the rest by forests during upcoming plan revisions. Considering possible displacement of snowmobile use from the parks, the Bridger-Teton National Forest indicates that increased use would destabilize a local balance between nonmotorized and motorized use, and not meet plan objectives. Similarly, the Caribou-Targhee National Forest states that increased use could exceed existing infrastructure and result in the need to amend its new plan. The NPS interprets this conflict as follows for all the forests involved. The forests have standards and guidelines that relate to quality experiences within the spectrum of recreational opportunities. Some forests do not have direction specific to winter use and recreation experience objectives. However, increased use could cause facility capacities to be exceeded. It could also cause heavy trail use that would not meet implied standards for quality use in a given management area. This impact indicates the need for management action to bring use into conformance with the plan – per the analysis in the Winter Visitor Use Management Assessment. The issue is nearly moot since the national forests indicate they are already at a threshold without any park management changes.

Displacement of Snowmobile Recreation Use to Adjacent Lands

To perform additional effects analysis on forest lands, the USFS requested the NPS provide information on how use would change in the GYA as a result of each winter use alternative for the parks. The NPS maintains that such information is speculative. Many different scenarios can be constructed for the same basic situation (for example, plowing the road from West Yellowstone to Old Faithful). Additional permutations are added when multiple alternatives must be dealt with, and even more when dealing with four major gateways and several other access routes. A partial list of possible considerations follows. Many nonresident visitors that presently snowmobile in the parks also snowmobile on the adjacent

national forests during the same trip. If they cannot snowmobile in the park from the gateway of their choice, they could:

- Continue to visit in future years but spend their time exclusively on national forest lands. The net increase would be the one or two days per trip previously spent in the parks.
- Continue to visit in future years but spend their time on national forest lands as before, and shorten their trip.
- Decline to come to the GYA and forego both national forest and park experiences.
- Continue to visit the GYA, spend as many days on the national forests as they do now and visit the parks using another gateway or a different mode of transport.

Other considerations include the possibility of attracting new visitors with new preferences, and different local users. Some people that have not come to the parks in the past might choose to do so because of available mass transit opportunities, either on plowed roads or groomed, oversnow routes. Such visitors could split their trips to spend a day snowmobiling on the adjacent national forests. Local snowmobilers would likely continue to use national forest lands as they have in the past. If they can no longer use the parks as they have traditionally done from their local community, they could:

- Enter the parks from another available gateway.
- Leave the region and go elsewhere for one to several trips over the season.
- Curtail their activity overall.
- Spend more time on local national forest lands.
- Visit national forest lands near of other gateways.

The development of a quantified scenario for future recreation use by alternative is speculative. The NPS provided scenarios of recreation displacement by alternative is in the FEIS. These represent the most reasonable outcomes based on known preferences of current visitors through visitor surveys and current use at each park gateway.[15] Appendix J in the FEIS provides supporting computations for this displacement analysis, including assumptions and methods.[16] The following analysis is brought forth from the FEIS and applied to the SEIS alternatives.

[15] CEQ Regulations at 40 CFR § 1502.22(b) address incomplete or unavailable information. Definitive information about what people would do under a variety of scenarios cannot be obtained. The best available data is from visitor surveys (Duffield 2000) designed to ask pertinent questions of current winter visitors in the parks. The results indicate what people may do under circumstances posed by key features of EIS alternatives. These surveys are also the basis for impacts described in the socio-economic section and are fully cited therein.

[16] As a cooperating agency, the USFS advocates the use of a worst-case scenario for displacement that might occur in each alternative. The worst-case might be represented by the total amount of park visitation by gateway or otherwise that would no longer be able to use that entrance. What those displaced visitors might do is highly speculative.

Alternative Displacement Scenarios

Alternatives 1a and 1b

Alternatives 1a and 1b would be the same as in alternative G from the FEIS. Based on survey responses of current winter visitors about what the visitor would do if the parks were open for snowcoach access only, total visitation to the GYA by those who live outside the 5-county area would be reduced by 33.4%. Nonresident visitors account for about 80% of park visitation. Nearly 60% of the visitors who snowmobiled on their trip said they would visit the GYA less frequently. The 33.4% reduction is a net change. It takes into account visitors who said they would visit more often in this circumstance, and those who said they would visit the same, but shift their use to other areas of the GYA (e.g., from the parks to the national forests). This means that total visitation to GYA national parks and adjacent national forests by nonresidents could decrease by that amount. Visitation numbers are unavailable for national forests, but an across the board decrease of 33.4% could offset or exceed any potential increase in use locally as a result displaced park use. Considering a net decrease in use in GYA national parks and on adjacent national forest lands in this alternative, about 5,230 snowmobile trips (into the parks annually) are associated with visitors who indicate they would visit in the GYA the same amount, but would go to other destinations. A total of about 65 snowmobile trips daily could be displaced to other available lands outside the parks near all gateways. This would be in addition to resident visitors (accounting for about 20% of park visitation) who currently recreate on adjacent lands.

Alternative 2

This alternative is, in respect to amount and type of access and the allowable snowmobile use, essentially the same as in FEIS alternative A.[17] Under alternative A there would be no redistribution of use other than what may happen at the influence of events unrelated to winter use management in the parks. Any impact on use distribution resulting from the requirement for use of cleaner and quieter snowmobiles would be the same as in alternative 3, so this effect is ignored. SEIS alternative 2 proposes an interim cap on use that is generally higher for all gateways of the three parks. The proposed interim cap at the west entrance of YNP in the third year of the phase-in is about the same as the current average daily entrance volume. On days exceeding 1,400 snowmobiles coming into YNP, there could be some diversion to national forests. On the average, on such days, about 50 snowmobiles

could be diverted from the West Entrance. Also, in alternative 2, Teton Park Road in GTNP would be closed. Current use consists mostly of local visitors, who could be displaced to the Parkway north of Flagg Ranch and YNP, or to lands on the Bridger Teton National Forest. An average of 10 daily snowmobile visits could be displaced in this fashion. Displaced use in this alternative is negligible.

Alternative 3

This alternative is, in respect to amount and type of access, essentially the same as in FEIS alternative A and SEIS alternative 2, above. The essential differences are associated with the amount of allowable use entering the park system at West Yellowstone, the requirement for use by guided tour only, and the prohibition on motorized use of Jackson Lake. Any impact on use distribution resulting from the requirement for use of cleaner and quieter snowmobiles would be the same as in alternative 2, so this effect is ignored. Even though the allowable use at West Yellowstone is decreased, the difference is made up by allowable use at the other gateways. Therefore, an argument can be made that displacement of West Yellowstone use would not affect adjacent lands but would be redistributed to other areas of the park. Alternatively, the same amount of use could be experienced in West Yellowstone, while those who wish to enter the park may need to pre-plan or reserve space with a guide having permitted use in the park. This could result in several scenarios:

- lengthier stays in West Yellowstone with the potential for increasing snowmobile visitor days on adjacent national forest lands;
- redistribution of use temporally within a single use season;
- redistribution to other park gateways;
- postponement of trips to later years;
- use of snowcoach access instead of snowmobile;
- greater numbers of snowmobiles with multiple-riders;
- or a mix of all these.

Any scenario, according to our best available information, would involve the difference between the allowable use at West Yellowstone of 330 and the average daily entrances of about 530, or about 200 snowmobiles per day. On peak days, especially from the West, several hundred snowmobiles could potentially be diverted until such time as the use has adjusted around the GYA. It would also involve possible displacement of an average of 40-

[17] Alternative A in the FEIS essentially represents the existing condition both then and now. See discussion of existing condition in Chapter I of this SEIS. Since access by snowcoach only has not yet been implemented even though it is the current management decision, conditions associated with essentially uncontrolled snowmobile use still prevail in the three park units.

45 snowmobiles per day on Jackson Lake and the Teton Park Road. The effect on visitation by a requirement for use by guided tour only is not calculable. However, NPS assumes that, because of the apparent high demand for access, the fully allotted use at West Yellowstone will be taken. With this assumption, no displacement would result strictly because of this requirement.

Impacts of Displaced Recreation Use on Adjacent Lands

Alternatives 1a and 1b

The scenario of use displacement indicates that substantially fewer nonresident snowmobilers would visit the GYA. Therefore, this displacement would not affect adjacent lands in the GYA. Resident users would be relatively unaffected because, for the most part, they currently recreate primarily on adjacent lands. On balance, the displacement has economic consequences disclosed in the socioeconomic section, while decreased use (from displacement) would relieve pressure on national forest infrastructure and natural resources.

Alternative 2

The scenario of use in this alternative is essentially unchanged from present snowmobile use patterns. Because no displacement in regard to current levels or locations of use would occur, there would be no effects on adjacent lands.

Alternative 3

Any scenario of displaced use, according to the best available information, would involve the difference between the allowable use at West Yellowstone of 330 and the average daily entrances of about 530, or about 200 snowmobiles per day. This amount of displacement could be divided among use on locally adjacent lands, use at other park gateways, use that comes at other times of the year, or that no longer visits the GYA. The effect of displacement would be limited to the national forests near West Yellowstone, in quantities ranging from zero to 200 snowmobiles per day. This would not appear to be a significant impact. Also, it is possible that the current average level of visitation in the park from West Yellowstone could be accommodated within the allowable limit by increasing the number of multiple riders on snowmobiles.

CUMULATIVE IMPACTS

The alternatives evaluated in this SEIS are within the range of alternatives for which cumulative effects were analyzed in the FEIS. That analysis appears in the FEIS on pages 478-485. The discussion in this document is tiered to that in the FEIS. Cumulative impacts

on resources and values for which analysis of effects is presented in the SEIS are discussed here.

Assumptions and Methodology

Cumulative impacts analysis considers the degree to which any direct or indirect effects from proposed actions adds to or detracts from the possible effects of other past, present, or reasonably foreseeable actions. Since effects of actions are specific to each impact topic, resource or value of concern, the types of actions and overall nature of impacts considered in this analysis are disclosed for each. Each impact topic is associated with a specific area of concern, and with impact sources that could affect the resource within that area. If an action or an alternative could have a direct or indirect effect, then this effect is considered additive with the effects of other impact sources. Conversely, if an action does not have a direct or indirect effect, no additive cumulative effect exists.

Socioeconomics

The appropriate level for viewing cumulative economic impacts is at the aggregate level for the GYA. As noted in the FEIS, the counties of the GYA are in a period of general prosperity, characterized by economic growth and low unemployment. This growth is largely fueled by desirable residential and quality of life environments, increasing tourism, and the ability of independent entrepreneurs to be located in desirable working environments some distance from their key markets. This is more than offsetting the decline of the traditional resource extraction industries in the regional economy, although it should be noted that average wages between the two sectors are not equal (with resource industries' being generally higher). During the general trend of growth through the period, it should be noted that annual levels of tourist visitation have been static or decreasing in some places during the past two years. To the extent that the alternatives tend to increase recreational visitation, this is additive to the existing trend. To the extent that the alternatives tend to reduce recreational visitation, the negative impacts are somewhat offset by the positive regional economic trend related to wildlife and natural environment. This is the only cumulative impact identified in this section. All alternatives evaluated in both the SEIS and the FEIS are intended to maintain the current level of recreational visitation in the parks, although modes of access differ. Therefore, the cumulative impact identified would appear not to vary substantially within the economic region by alternative.

Air Quality

Area of Concern. The area of concern includes the airshed described by all three park units and by adjacent Class I areas on national forests. Although ambient air pollution generated at great distances beyond the park boundaries are of concern relative to air quality in the park, it is unreasonable to consider the whole of the western United States as an area of concern.

Potential Impact Sources. Additional pollution comes from regional industry located within 150 km of the park. Industries include oil and gas processing, power plants, and industrial combustion. Levels of nitrates found in YNP's snowpack can be related to regional industry (Ingersol et al. 1997). Current impact sources within the parks that could affect park air resources during the winter include emissions from 2-stroke engines and other motorized wheeled vehicles (or internal combustion engines) that operate on open roads within the parks, as well as wood-burning stoves. During other seasons, human-related sources of pollution include motor boats, gasoline powered maintenance equipment, recreational vehicles, busses, generators, ambient sources, automobiles, campfires, and road material processing equipment. Forest fires in both the parks and national forests impact air quality during the summer and fall seasons. There is no known connection between potential sources of air pollution in the winter and potential sources in the summer. Therefore, these sources are not additive as cumulative effects. Effects on vegetation, or other air quality related values from auto emissions, are largely hypothetical. Such an impact could be attributed to the large amount of summer automobile use when plants are actively respiring.

Additional Impact. In YNP and GTNP obvious visual effects of air pollution are usually short term and local. The cumulative effect of winter use, added to other possible sources of pollution in the parks, is considered to be short term and localized around parking destination and staging areas, entrance stations, and attractions such as Old Faithful. Effects other than visibility are of concern in these local areas, including health impacts. In alternatives 2 and 3 the application of "cleaner" technology could result in a net reduction of cumulative impacts within the area of concern, relative to the existing condition. In alternatives 1a and 1b, elimination of snowmobiles could significantly reduce the risk of degrading air quality related values in these Class I areas. In these alternatives, increased snowcoach use (relative to current use) would offset some of the gain, but the amount of air pollution generated per visitor would be significantly lower.

Wildlife

Bison

Area of Concern. The area of concern is that which is used by bison for wintering and seasonal migration. Generally, the area includes the corridor and adjacent available winter forage areas in the northern area of YNP and into Montana, and the western corridor along the Firehole and Madison River. The bison issues were addressed in the Bison Management Plan/EIS referred to in *Other Plans and Environmental Analyse*s, Chapter I.

Potential Impact Sources. Because the area of concern is tied to bison winter habitat, impact sources include winter uses — motorized and nonmotorized — that displace bison from that particular habitat or render the habitat unusable for them. Activities such as trail grooming that facilitate bison movement in the winter (with less energy expenditure) also facilitate the recreational uses that can stress bison and cause higher energy expenditures. Bison movement along groomed and open roads can lead to the complex economic and social issue of migration to lands beyond park boundaries. Bison have been shown, however, to leave the park more in response to a variety of circumstances, and often not on groomed surfaces. For further evaluation of impact sources refer to the Bison Management Plan/EIS. Actions being considered in the Bison EIS include closing sections of road to winter motorized use and limiting bison use of groomed surfaces.

Additional Impact. For consideration of the total cumulative impact on bison, and how winter use contributes to it, this analysis incorporates the Bison Management EIS and Plan. Refer also to the disclosure of direct and indirect effects earlier in this chapter.

Ungulates other than Bison

Area of Concern. The area of concern includes habitat for various species within the three park units and other seasonal habitat beyond the parks' boundaries. Ungulate species are migratory and some herd units will disperse onto adjacent jurisdictions and land ownership primarily for winter habitat and forage.

Potential Impact Sources. Other impact sources include those that might occur on adjacent lands. This includes conflicts with other human use activities such as ranching, hunting, and general recreation. Development on private lands, loss of open space habitat, or road construction on other federal jurisdictions are other possible sources. Within the parks, similar actions represent impact sources — housing and road construction, grazing in GTNP,

as well as increased recreational use. The most relevant impact sources are those which occur during the winter, on or off the parks.

Additional Impact. The direct and indirect effects described for winter uses in the parks are key limiting elements for cumulative impacts. Stressed animals or herds whose winter forage options have become limited are likely to be affected cumulatively, through the additional impacts imposed by winter recreation use in the parks. Alternatives that limit all winter recreational use to trails away from thermal areas and close backcountry areas would decrease adverse cumulative impacts on ungulates.

Natural Soundscape

Areas of Concern. The area considered for cumulative impact assessment is the natural soundscape within the boundaries on three park units.

Potential Impact Sources. Because individual sources of sound are transient and short lived, the potential cumulative impact on the winter soundscape are those sounds occurring during that time. Sounds other than those that naturally occur in the park units during the winter include the sound of wheeled vehicular traffic along open roads, the sound of oversnow vehicles on groomed routes, aircraft overflights, and sounds attendant to facility developments open in the winter.

Additional Impacts. Where open facilities coincide with roads and oversnow motorized activities, the natural soundscape is impacted. There are areas in the parks where the total cumulative effect is such that it renders the natural soundscape to be seldom evident for most of a winter day. On a relative scale, there would be a lower level of cumulative impact under alternatives 1a and 1b, followed by alternative 3 and then by alternative 2. The relationship is defined by the numbers of vehicles allowed in each alternative.

Visitor Experience

Areas of Concern. The area considered for cumulative impact assessment is that within the boundaries of the three park units.

Potential Impact Sources. Because visitor experience is a multi-faceted value, during the winter it can be impacted by a large variety of sources. This SEIS illustrates the sights and sounds of a variety of modes of transport including buses, trucks, groomers, and autos. Visitor experience is also impacted by the numbers of other visitors in addition to their modes of transport. Ambient human-caused noise such as aircraft overflights generally affect visitor experience. When facilities such as lodges, restrooms, or comfort stations do not

accommodate the amount of visitor use (crowding), the quality of the experience declines. Responding to this issue, the number of facilities can grow to a point where the park no longer reflects its mission of providing a natural environment. In terms of impacts, all potential sources boil down to the number and the relative obtrusiveness of other people, facilities and transport vehicles. As these sources increase per unit area other impacts may be evident such as the impact of viewing disturbed wildlife as a secondary impact on one's visitor experience.

Additional Impacts. The indices to cumulative impacts on visitor experience are the number and relative obtrusiveness of other people, facilities and transport vehicles. On a relative scale, there would be a lower level of cumulative impact under alternatives 1a and 1b, followed by alternative 3 and then by alternative 2.

ADVERSE EFFECTS THAT CANNOT BE AVOIDED

The range of adverse effects in SEIS alternatives lies within that range disclosed in the FEIS. Each alternative evaluated in both the FEIS and the SEIS, including implementation of the current management plan, would result in some impacts.

Impacts are discussed for human health and safety, the economic and social environment, physical and biological resources, and the experiential environment of the three parks. These elements are interrelated and interdependent, as is the nature of any ecosystem process and the human role in it. Therefore, the alternatives taken together display consequences, tradeoffs, benefits, impacts, and opportunity costs in a way that reveals the interdependent working of human and natural park systems. This means that, considering the human use and enjoyment of national parks, an adverse impact from one perspective is often a benefit from another. For example, a change from the existing condition to management under alternatives 1 or 2 results in the loss of experiential quality for snowmobilers in the parks -- although these visitors may still avail themselves of motorized access using snowcoaches. At the same time, visitors who have avoided the parks due to the presence of snowmobiles, or who have been unable to enjoy a quality experience due to their presence, will benefit from this change. Any alternative that has been evaluated can be viewed in the same light.

Potential unavoidable adverse economic impacts on the regional economy are disclosed for all alternatives that depart from the existing condition described as alternative A in the FEIS. The decrease or loss of snowmobiling opportunities in the parks readily equates to an adverse economic impact. These impacts are not considered irreversible or long term in the

context of the total economy. For some individual businesses, the effects may be more drastic. It is, however, in the nature of business to start or change course based on economic self-interest and survival. Long term economic impacts are not easy to determine because of this dynamic, and because the business world is adaptable and creative. So, as indicated in the analysis, it is possible that the negative regional impacts of some alternatives could be offset by a change in the type and mix of visitors coming to the parks.

Potential unavoidable adverse impacts on physical and biological resources are disclosed through the range of SEIS alternatives. These include impacts on air quality, wildlife displacement and habituation, and natural quiet. For the most part, any such impacts are short term (for the duration of the impact cause) and minor. Other possible minor to moderate impacts would be mitigated or avoided by the features of the alternatives or the recommended mitigation measures expressed in specific analyses.

Current impacts on human health and safety represent a major part of the purpose and need for action. Considering the existing condition described in Chapter III, with reference to the FEIS, most alternatives represent an attempt to improve factors relating to health and safety. The focal points regarding health and safety in this SEIS are air quality and emissions from snowmachines, motor vehicle accidents and behavior of various recreating user groups. The desired impact is beneficial in reducing these factors. Allowing the range of winter recreational use and access, which is implicit in the purpose and need, carries with it unavoidable potential for accidents. Unavoidable impacts are referred to in the beginning of *Effects Common to all Alternative*s, Chapter IV. These result from winter use of the parks at any level, and they include impacts on: natural soundscape; wildlife (collisions, displacement); safety; and visitor experience.

IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

An irreversible commitment of resources is defined as the loss of future options. The term applies primarily to the effects of using nonrenewable resources, such as minerals or cultural resources, or to those factors, such as soil productivity that are renewable only over long periods. It also could apply to the loss of an experience as an indirect effect of a "permanent" change in the nature or character of the land.

An irretrievable commitment of resources is defined as the loss of production, harvest, or use of natural resources. The amount of production foregone is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume production. An example of such a commitment would be the loss of cross-country skiing opportunities consequent to a decision allocating an area to snowmobile use only. Should the decision be changed, skiing experiences, though lost in the interim, would be available again.

From an economic or social perspective, there would be no irreversible commitment of resources from any of the alternative actions. However, alternatives to the current management situation that change recreational opportunities or affect visitors by displacing them from accustomed usage, would involve irretrievable losses. By the nature of alternative actions, those losses would be balanced by a gain in some other opportunity or resource benefit. Any perceived losses or tradeoffs in recreational opportunities would have both social and economic consequences that would be irretrievable, but not irreversible.

By virtue of the alternative actions, which are fully within the protective orientation of the national park mission, and the analysis of effects from them, there would be no irretrievable commitments of any resources. No environmental consequences have been determined that involve the permanent loss of a resource or jeopardy to the existence of any species on the basis of the proposed actions alone. Were it indicated that the presence of existing or proposed levels of snowmobile trail use could cause grizzly bear mortality, then there would be a risk of irreversible and irretrievable commitment of resources. As stated, no such impacts were determined in this analysis.

The four alternatives prescribe changes from the existing condition for different mixes of winter visitor experience. The changes are intended to address the purpose and need for action described in Chapter I, while sharply defining the public's issues about the proposal. In alternatives 1 and 2, the consequences of those changes improve the quality or condition

of the parks' experiential values and resources. This includes improving values like air quality, natural quiet, wildlife species and habitat, and recreation experiences (motorized and nonmotorized) whose quality is dependent on those values. The achievement of such improvements is accompanied by some tradeoff in another aspect of winter recreation such as loss of snowmobiling opportunities, available modes of transport, redistribution of use, or regulating types of equipment allowed. All these changes or tradeoffs would be associated with an irretrievable loss of the kind indicated. Conversely, for alternatives that provide a full range of winter recreation opportunities, including snowmobiling, there would be tradeoffs representing irretrievable losses in types and qualities of other visitor experiences. For the range of alternatives a variety of irretrievable resource commitments would be made, but none would be irreversible.

THE RELATIONSHIP BETWEEN SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

All the activities implied in the EIS alternatives could be considered local and short tem, in that they are specific to the three park units and are reversible actions. Long-term productivity is construed as the continued existence of the natural resources of the parks, at a sustainable and high level of quality, so that they can retain their inherent value and be enjoyed by the public. Depending on the magnitude, extent, and duration of impacts caused by short term uses, long-term productivity could be affected.

The analysis in the FEIS has shown few impacts from possible short term uses that would affect long term productivity as defined. It is the function of monitoring and mitigation, incorporated into park management, to ensure no such impacts result from implementation. Adaptive management is a dominant theme in all SEIS alternatives. Adaptive management addresses this relationship (monitoring and management) directly and programmatically. Otherwise every alternative would induce short-term effects on a variety of experiential values or resources that would persist for as long as the impacting activity is undertaken. Programmatic changes in opportunities affecting visitor experience and use (the "enjoyment" part of the mission) would continue for the duration of plan implementation.